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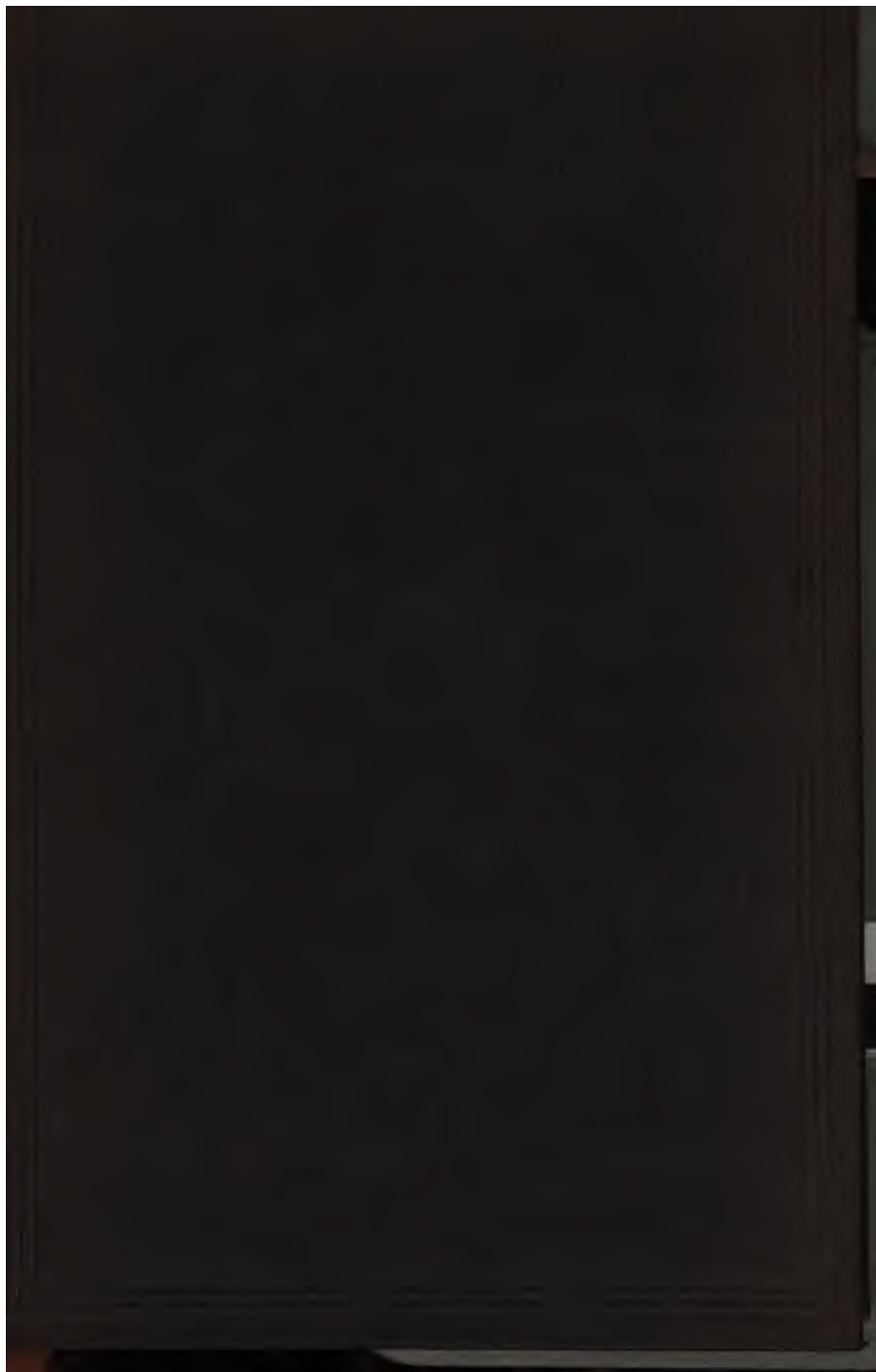
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NOTES
ON
THE HYGIENE OF CHOLERA

FOR READY REFERENCE.

BY

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Mon bien le plus précieux, c'est le santé du soldat. — TURKINNE.



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INTRODUCTION.

1. In the following *Notes* prepared in the first instance for the guidance of Army Medical Officers doing duty under my superintendence, I endeavour to summarise, as far as practicable, what I find written on the subject of cholera, as that disease is likely to occur among troops under their care.

2. It is, I think, extremely desirable that Army Medical officers should have means of ready reference to such a summary, to enable them on the occurrence of an epidemic, and in the midst of the hurry and anxiety inseparable therefrom, to refresh their memory in regard to evidence adduced for and against the several controverted points in relation to the disease to which attention has been called.

3. I have in many instances quoted the conclusions recorded by International and other Commissions of Inquiry in regard to cholera. I have done this, because such conclusions have been arrived at by men of eminence, holding individually diverse opinions, after careful study on their part of evidence, oral and written, brought before them from many different sources.

4. I have intentionally avoided quoting the names of individual writers. On the one hand, I have been induced to do so by a desire to avoid anything like a desire to enter the field of controversy, rather than adhere to the analysis of facts; on the other, because, however eminent some individual authors may be, still the views in most instances expressed by them are after all but individual views based upon individual experience.

5. It seems to me to be demonstrated that the phenomena of cholera vary in different epidemics and places, that conclusions drawn from one set of circumstances in relation to the disease, may be found more or less inapplicable under other conditions; and that therefore it is a dangerous assumption, that

because a particular observer has seen such and such phenomena in connection with an epidemic or epidemics under his observation, the conclusions arrived from his sphere of observation must be applicable to all other epidemics and conditions.

6. It has been my desire to avoid giving expression in a dictatorial tone to the various views I have quoted, even where, as has at times happened, those views as they occurred in original documents consulted were so expressed. I have considered it expedient to assume that in all cases the opinions expressed were formed after careful observation of facts as they presented themselves to particular observers, rather than from a desire, no doubt unconscious on their part, to accommodate observed facts to preconceived theories; also that the differences recorded between the views of observers indicate to a considerable extent at least, actual variations in the phenomena of epidemics, according to the varying localities, circumstances and conditions in which the latter occur.

7. I trust that the method of arrangement I have adopted will enable Army Medical officers not only with facility to observe phenomena connected with epidemics of cholera, but also to record such phenomena systematically. It would be a matter of vast importance were medical officers at the same time to trace, as far as possible, the actual sources of the difference that have been recorded in relation to those phenomena, and thus help towards something like a correct knowledge of the laws by which the scourge is regulated.

8. As my Memorandum is intended to be strictly professional in its nature, so Army Medical officers into whose hands it may fall, are enjoined to observe in their integrity all official orders now existing, or that may hereafter be published, for their guidance in relation to cholera.

C. A. GORDON, SURGEON GENERAL,

Principal Medical Officer British Forces,

Madras Presidency.

AN APPEAL TO THE READER.

—:o:—

If we are ever to obtain a true insight into the ultimate causes by which the phenomena of cholera are produced and regulated, it seems to me that so desirable an end can only be attained by long and careful registration of facts in the first place, and analysis of them in the second. At the same time it is of importance that facts, to be of value, should be actual, not apparent only; it is also to be observed, that those of a negative nature are no less valuable than such as are positive.

The importance of the question is so great that I am prepared to continue its study during the working years, if any, yet left to me. Readers of these pages therefore who are themselves interested in the study of cholera, are urgently requested to favor me with such *facts* bearing upon the several points alluded to as have come within their own knowledge, or are otherwise duly authenticated; for although the preparation of the volume now presented has entailed an amount of reading far beyond what may at first sight appear, it cannot be said to contain more than a tithe of facts that bear for and against the several points referred to in it.

May I request that such of my readers as are disposed to communicate to me the information solicited, will be so good as to give a reference to the chapter, paragraph or section of my *Notes*, in favor of, or adverse to, which the *facts* brought forward by them are so adduced, confining their remarks to a narrative of actual occurrences? Also, that when quoting from published works or observations other than their own, they will kindly give such reference as may enable me if necessary to verify their quotations.

Members of the profession or others in India who do me the honor to communicate to me the information now solicited, will further oblige me by addressing their letters to me by

name, adding thereto the designation of my office, namely, "Principal Medical Officer British Forces, Madras," and writing outside the envelope the words "*Facts regarding Cholera.*" Those in other countries than India are requested to kindly address similar communications to me to the care of the "Director General Army Medical Department, Whitehall Yard, London." Medical officers of Foreign armies or other branches of Public Service have it in their power to transmit communications with which they may favor me, through the ordinary official channels.

C. A. GORDON, *Surgeon General.*

MADRAS, }
February 1877. }

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ERRORS AND CORRECTIONS.

VII-3.....	For nor does <i>in</i> , read <i>nor does it</i> .
IX-11	„ 1876 read 1866.
XIII-1	„ <i>in clayey</i> , read <i>on clayey</i> .
XXV-3	„ it has <i>exceeded</i> , read <i>extended</i> .
— -5	„ <i>fail</i> , read <i>fails</i> .
— -7	„ <i>Iphigeni</i> , read <i>Iphigenia</i> .
— -9	„ <i>diseas</i> , read <i>disease</i> .
XXVIII-1	„ ever exceeded, read <i>ever much exceeded</i> .
XLV-4	„ from this, read from <i>these facts</i> .
L-3	„ 1827, read 1867.
LIV-8	„ that year, read <i>was</i> that year.
LVIII-6 (e)	„ India, read <i>Indiana</i> .
XLI-1 (i)	„ 203 read 230.
LXXI-5 (h)	„ in ship, read in <i>the ship</i> .
LXXV-2 (e)	„ Saint, read <i>Sainte</i> .
LXXXII-2	„ They, read <i>Commissions</i> .
— -6 (a)	„ No body, read <i>No body of troops</i> .
LXXXIII-6	„ there, read <i>their</i> .
— -6	„ Kenman, read <i>Kerman</i> .
LXXXIV-4	„ erformed, read <i>performed</i> .
CI-4	„ prèircs, read <i>prières</i> .

I. CHOLERA.

1. Cholera may occur (*a*) in sporadic or isolated cases ; (*b*) be restricted to so-called endemic areas ; or (*c*) extend far and wide as an epidemic.

2. The severity of attack varies on different occasions ; also in different persons and localities. At one time an apparent connection exists between two or all of these three forms of the disease ; at another, none can be detected. The disease, mysterious in its manner of occurrence, prevalence, and disappearance, resembles in these respects some other maladies that occasionally prevail as epidemics, more especially yellow fever, small-pox, influenza, and scarlatina.

3. On the occurrence of an epidemic of cholera, the initial attacks of the disease are, for the most part fatal. The epidemic manifests its period of inception, increase and decay. It usually attains its maximum degree of severity and prevalence on the tenth day of its occurrence. From that time its decline is indicated by the lessening severity and number of attacks.

4. Culmination of an epidemic sometimes occurs at the same time in places far apart from each other ; in other instances at intervals, longer or shorter, as the case may be.

5. Different epidemics are characterised by different degrees of intensity. This circumstance has been observed in India, Russia, and elsewhere. The same epidemic may rage with different degrees of intensity at places separated by only a small distance from each other.

6. Individual attacks are of all degrees of intensity. In some diarrhoea, with or without malaise, takes the place of

more developed symptoms. In others, collapse and spasms—the latter amounting in their severity to actual tetanus, present themselves from an early period of the attack.

7. One attack of cholera gives no immunity from others. Reports of epidemics of the disease in France, America, Russia and India, contain many examples in point. Among others, the case is given of a person who sustained three attacks in an equal number of weeks; of another who was twice attacked and recovered; of persons in France attacked in each of the epidemics previous to that of 1855 being also attacked in it. On the other hand, instances are recorded in the French reports of persons attacked in one epidemic escaping in a succeeding and even more generally fatal outbreak. Instances of both classes of occurrences are frequent in India.

II. SPORADIC CHOLERA.

1. Some writers take exception to the term sporadic, on the ground that no apparent difference exists between the phenomena of a case so called, and one of epidemic cholera. The majority of writers however, make use of the term as an expression of convenience.

2. Sporadic or isolated cases occurring repeatedly are, on many occasions, preliminary to a general outbreak of the disease. In 1831 the outbreak of the epidemic at Sunderland was preceded by the occurrence of sporadic cases. At other places isolated cases occurred without being followed by a general outburst. In 1849 the recurrence of such cases was looked upon in Scotland as warnings of the approaching epidemic. In 1859 the epidemic at Cochin was, for several days, preceded by the occurrence of sporadic cases, said to be under the epidemic influence.

Prior to the epidemic in Russia in 1868, sporadic cases were present, especially in the western portion of the empire. According to some writers the occurrence in India of sporadic cases during the same year, was but the precursor of the epidemic of 1869 in that country. In August 1869 isolated cases occurred among workmen at Kiev, they continued to recur till the following October when a fatal epidemic of cholera broke out. In Upper India in 1872, as in several other years, the outburst of the epidemic at a number of stations was preceded by sporadic attacks. In 1873 the outbreak of a disastrous epidemic of cholera in America was preceded at various places by one, sometimes more sporadic cases.

3. In at least one respect a difference is by some observers said to exist between sporadic and epidemic cholera. The former, when unconnected with epidemic influence, is altogether of an individual character, and not believed capable of being communicated by the subject of attack to another person. The sporadic form may arise from the use of unwholesome articles of food.

4. Yet the difficulty comes to be, how to distinguish on its first occurrence between a case that is connected with an epidemic and one that is not. There is evidence that sporadic cases when connected with an epidemic may communicate that form of the disease.

5. There is every reason to believe that an epidemic may manifest itself in the occurrence of a large number of isolated or sporadic cases. This has been considered to happen from time to time in India. Thus at Hazarabagh, in 1869, the epidemic approached from a distance, and destroyed many persons in the bazaars, jails, and regimental lines; in 1870 it showed itself only in isolated cases.

III. ENDEMIC CHOLERA.

1. Cholera, which has invaded the world, is by many writers considered to have originated in the valley of the Ganges, and there, at the present time, to exist endemically.

2. Besides being endemic in that valley, there is reason to believe that it is so in India generally; in Indo-China, some Islands of the Indian Archipelago, Affghanistan, Belochistan and southern coast of the Persian peninsula.

3. In India cholera is considered to be endemic, chiefly in and about Calcutta, Allahabad, Cawnpore and vicinity, Arcot in Madras, and at Bombay. How far the disease is endemic anywhere in the Madras Presidency has been questioned by local committees. As a matter of fact, statistics indicate the annual existence of the disease in this Presidency during the last sixty years.

4. There is nothing in the soil of those places to distinguish them from others. The theory has been adduced that the cause of endemicity in them exists in neglect of ancient water works, but it is observed in reply, that all such works had fallen into a condition of neglect during the period of quiescence of the disease, namely, between 1783 and 1817; and that since the latter date they have been much improved and added to.

5. The conclusion arrived on this point is, that the cause of cholera being endemic has not yet been discovered, nor do any of the theories adduced explain it. All the localities in which the disease exists endemically are not known, neither are the limits of a given place, nor the connection between endemicity of the disease and its epidemic development.

6. According to the International Conference, the causes of endemicity in India are not constituted either by the alluvial deposits of the Ganges, the custom of throwing dead

bodies into the river, the hydraulic works of the country, the nature of the soil, climate, habits or food of the people.

7. Nor does it appear that India and the neighbouring countries are alone the home of endemic cholera. It cannot be actually asserted that cholera is not endemic in Europe, Africa and America. In 1866 cholera appeared in Paraguay among a body of American soldiers, followed the course of the rivers, infected all the cities and towns on their banks, remained endemic three years, and then disappeared. Prior to 1866 cholera was unknown in Paraguay and La Plata, it then appeared among armies stationed at Estero Bellaco, and on their removal disappeared at that place; no vessels from infected ports are known to have arrived; but it is recorded that "the combination of causes at Estero Bellaco resembled those presented in India." What are they?

8. Various facts are on the other hand, adduced against the so-called endemic area in India having been originally confined to the Gangetic valley. In 1757 to 1780 many epidemics of cholera occurred in the south of India, near Madras, without a trace of the disease elsewhere in India at the time. In 1781 it prevailed similarly in Ganjam; in 1783 at Travancore. The older history of the disease relates its occurrence also in Rajpootana and Bundelkund to the exclusion of Bengal; at Hurdwar, while the lower course of the Ganges was free from it. When, in 1817, it prevailed in places remote from Bengal Proper, that province was free from it. In effect it was carried to Jeypore from without. It broke out in remote places at such short intervals of time that its general diffusion was considered to have been owing to some *general* cause. In its progress it reached Bengal. It was considered to have obtained a focus at Jeypore, whence it subsequently spread.

9. Indeed, some writers assert in opposition to the theory of cholera endemicity, that there are no sufficient proofs of

the disease being anywhere purely endemic. Nor is endemicity shown to exist in all the provinces of Hindoostan.

IV. EPIDEMIC CHOLERA.

1. An epidemic of cholera may occur (1) in an endemic area, (2) in a territory into which the disease has entered from without. Thus it may be limited to the region in which it first appears, or extend from it to others beyond.

2. Numerous instances are adduced in support of the disease being in certain epidemics limited to the area of origin. In 1781 the disease occurred violently among a body of pilgrims assembled at a fair at Travancore, killed 2,000 of them, and then disappeared without spreading. From 1870 to 1873 in Russia it was chiefly confined between 41° N. to 60° N., and long. 15° E. to 40° E.

3. It is said to be often developed without the presence of sufficient appreciable cause. The exciting cause of epidemic manifestation is unexplained by any existing theory. Not only is this true of cholera, but also of other epidemic diseases. It affects large numbers of persons and places the most diverse in condition and physical characters.

4. In this form the disease often appears suddenly; it at times returns after short intervals; it may be confined to particular localities, or may spread far and wide; it may pass over places in its progress, and either leave them altogether free, or after a time return to them. It has periods of little and great activity, of increase, culmination and decline.

5. Epidemics may prevail at different places without any traceable connection with each other. Thus in an outbreak (in 1871 ?) the disease prevailed at Brusa, without any connection being traceable between it and the general

outbreak in Russia. The simultaneous occurrence of the disease at places far apart has frequently been observed. In others the extension of epidemics is progressive. Their degrees of intensity are various. So also does their diffusive energy. Sometimes a space in the course of an epidemic is, as it were, passed over, either to be left exempt during the existence of the particular epidemic or visited by it at a later period of its course. For the most part epidemics are most severe in cities and wherever else population is most dense, less wherever population is thin and scattered.

6. According to some writers several outbreaks of cholera may occur, due to the same development of epidemic influence, the disease after a period of increase becoming dormant, again to manifest itself in force. The period of duration of such epidemic is stated to be not more than four years, beyond the endemic area, and often less. In this way cholera is said to follow the same rule as small-pox and other epidemic diseases. The theory here stated, however, needs the confirmation of facts.

V. RELATION BETWEEN ENDEMIC AND EPIDEMIC CHOLERA.

1. During the 17th and 18th centuries cholera was recognized to occur as an endemic in several places, and at times breaking out as an epidemic in them. At the following places a similar phenomenon still, from time to time, occurs, namely, at Madras, Conjeveram, Pooree, Tripetty, Mahadeo, Trivellore, and some other places where pilgrims assemble.

2. It has been asked, What is the connection existing between the endemicity of the disease and the development of epidemics in India? also, Has every epidemic

its root and origin in an endemic area? To both these questions replies have yet to be given.

3. In India, where the disease is endemic, epidemics spring periodically into existence in the absence of fresh infection. Some writers see every reason to believe that the epidemic outbreak in Bengal in 1817, was but the ordinary endemic disease intensified by the unusual weather of that year. Out of India it is considered determined that in all such instances fresh infection has been traced.

4. Yet, when in 1870 cholera appeared as an epidemic in Eastern Africa, it came from the interior of that continent, and there was nothing then apparent to show where it had originated.

VI. PERIODS OF INCREASE AND DECREASE.

1. It would appear from records of cholera that, since about the year 1500, it has shown in India definite periods of increase; that from then till the early portion of the 17th century, there were periods when it prevailed with great malignity, succeeded by others of decline, and that in the latter portion of that century this period of decline extended over fifty years.

2. There was little of the disease in the delta of the Cauvery in the early part of the 18th century; towards its middle extensive epidemics of the malady prevailed there; and towards its end they seemed to decline. In Lower Bengal there was little cholera during the last half of the 18th and at the beginning of the 19th century; but in 1817 the disease broke out with great violence.

3. At Bombay the disease which had, for a considerable time prior to 1750, been there unknown, reappeared. From 1756 to 1773 there seems to have been an absence

of the disease in Bengal. In 1781 it prevailed in Bengal, and from that date till 1817 it is recorded that it had become scanty ; that there was evidently a period of comparative quiescence. In Great Britain the virulence of the disease is considered to have been greater in 1838, 49, 54 and 66 than in 1832, 48, 53 and 65.

4. According to some authors the present time is the commencement of a period of decline. But there are others who doubt this cycle ; among them some who have little more faith in the periodicity of cholera than certain Americans have in " the forty year flood of the Mississippi."

VII. RECURRING EPIDEMICS ; RECRUDESCENCE.

1. It is observed that there are some localities in as well as beyond India that maintain cholera for a number of years, and where, without renewal of the population, a recurrence of outbreaks of the disease takes place. With regard to such, the question arises, Does this character, if it really exist, depend upon any peculiarity of the soil or locality ?

2. An explanation has, indeed, been given, to the effect that it depends upon " the capacity of the soil of a locality for the cholera principle." It is evident, however, that this is merely an abstract expression.

3. Experience has shewn that, under ordinary circumstances, a locality which has been devastated by cholera, loses the property of transmitting the disease to the newly arrived very soon after the complete extinction of the epidemic. In French reports places under this condition are described as *épidémisée*, or *cholerisée*. This remark is not applicable however, to the arrival of pilgrims ; nor does it appear easy to assert that when attacked they have not brought the disease with them from elsewhere.

4. In some instances of recurring epidemics, the second is more severe than the first. This is said to have been the case in the outbreak of 1818 in Bengal as compared with that of 1817 ; also in regard to the epidemic in Northern India of 1856 as compared to that of 1852. In other instances the converse takes place. Thus in Western Poland the epidemic of 1852 was very severe, that of 1853 very slight.

5. It becomes very difficult under many circumstances to distinguish between an epidemic solely due to *recrudescence* of the cholera principle retained from a previous outbreak, and an epidemic the result of fresh introduction. Thus, according to some writers, the several epidemics of cholera that visited Europe and America at intervals from 1831 to 1871, were due on each occasion to *recrudescence* of the choleraic principle introduced in 1847 ; also, that the epidemic in Russia in 1871 was a *recrudescence* of that of 1865. Thus they assert that the outbreak of 1830 lasted eight years, that of 1847 twelve, the latter aided by fresh importations. From 1847 to 1859 it was always present in some parts of Europe during the summer and winter months. In America it is considered to have been persistent from 1848 to 1854. It lingered at Kiev from 1865 to 1869, but was constantly reinforced by cholera arrivals by way of the Red Sea, Persian Gulf and by the North Persian route.

6. On the other hand it is observed that the persistence of the disease in 1869-70, and 71, and the migratory character of the disease on the latter occasion, fail to support the theory of *recrudescence*. In January 1849 cholera in New York began to disappear. In April it recurred, several ships with infected immigrants having meantime arrived. After the American epidemic of 1866-67 had subsided, that country remained free from the disease for six years, at the end of which time the disease was again introduced by infected ships. The International Commission of

1866 considered that the moving outbreaks of cholera in Russia from 1852 to 1856 were probably due to importation and re-importation of the disease, and not solely to recrudescence of that of 1847-48; also, that as the Russian epidemic of 1869-71 followed upon the general prevalence of the disease in Persia, it was probably introduced from the latter country. In Taganrog and other places in the Russian empire, the several occurrences of cholera from 1865 to 1870 could, it is asserted in every instance, be traced to communication with infected places.

7. In India cholera has, for a considerable period, appeared at intervals of four or five years; notably in the North-western provinces of Bengal, in all parts of Madras and Bombay, and in Burmah. Cochin had been free from cholera during four years prior to 1859. In that year it suffered severely by the disease. Similar instances are numerous. The disease seems to sink down everywhere just prior to its greatest outbursts. These take place in India during each hot season, the epidemic influence being asserted by some writers to hybernate during the winter. The choleraic influence is generally acknowledged to be capable of becoming localized in camp grounds, barrack rooms, hospital wards and ships, and to be capable of resuming an active character within *endemic areas*, although the precise conditions necessary for such an occurrence are as yet undefined.

8. A recurrence of a cholera epidemic may take place in a body of men shortly after a first outbreak when in the interval they have undergone a change of circumstances and conditions. Thus, in 1855, cholera occurred among a body of troops on board ship proceeding from France towards the Crimea, and speedily disappeared. On their landing at Constantinople it reappeared among them with great violence.

9. According to the International Conference, cholera, "like other contagious diseases," can only be re-generated under certain conditions, and in the absence of them it dies away. Thus "it is not enough merely to cast a grain on the soil hap-hazard to cause reproduction of the plant from which it is taken; it is necessary that the soil should contain all the elements favourable to the germination of the seed." With regard to the cholera principle, the elements and conditions alike of its death and its recrudescence remain to be determined.

10. On some occasions a locality visited by an epidemic one year is exempt from the epidemic the next, while places in the vicinity are infected. Sometimes such localities suffer at a later period of the outbreak, sometimes the same year, and on some occasions not until after an interval of several years. On occasions a territory visited by an epidemic of cholera may be so by a second, the limits of both being almost identical. Thus a map of the American epidemic of 1833 nearly quite represents that of 1873.

11. A recurring epidemic may be confined to one locality and not spread beyond it. Thus in Scotland, in 1848, and in London the disease was in many instances limited to the streets, houses, and filthy rooms that had been visited by the epidemic of 1832. In 1851 the recurring outbreak in Malta was confined to Isola Gate Barracks; in 1871, a month after the first outbreak in 18th Hussars at Secunderabad had ceased, it attacked and was confined to the Royal Artillery there.

VIII. CAPRICIOUS ATTACKS.

1. Cholera has been known to attack persons on one side of a street or camp, and not those on the other; to extend along a particular street to a particular point, and

there abruptly cease ; to affect men in one part of a ship and leave those in another free ; to attack one set of troops in cantonments, or a portion of one set of the same or different nationalities while the others escape.

2. It not unfrequently attacks the men of one regiment in an Indian station and spares another, the circumstances and conditions of both being to all appearance alike. This happened at Jaulnah in 1814, and has frequently been recorded elsewhere in more recent times. It was also seen in the Indian epidemic of 1872.

3. It often passes over places in its progress, to all appearance similar to those on either side which it attacks ; sometimes leaving them altogether exempt, at others returning to them before the termination of the epidemic. In 1818 its manner of falling upon a place was most capricious. Sometimes it made a circuit round a village and passed on, leaving it untouched, then after some days or weeks returned to and nearly depopulated it. In 1831 some villages around Paris were severely visited, while others absolutely escaped, all their apparent conditions being alike. Similar occurrences have often been described in subsequent epidemics.

4. On some occasions men are left entirely exempt, while their wives and children fall victims ; in others while men are attacked their families remain exempt. This was particularly observed in India in connection with the epidemic of 1867.

5. The occupants of one particular barrack-room may suffer, while those of all the adjoining rooms escape, examples are numerous. Thus in 1870 the men in one barrack-room in Fort St. George suffered by the disease to the exclusion of those in all other parts of that fort.

6. Nothing can be more capricious than the variation in the intensity of cholera in different places at different

times, and even at different times in the same place. In 1848 the disease prevailed at Dinapore, and very severely at Cawnpore, while at the intermediate stations of Benares and Allahabad little was heard of it. In 1866 Manchester was comparatively exempt, while Liverpool suffered severely. Similar instances are numerous. An imported case may end in a local attack confined to a single room or house. A simultaneous importation of a number of cases, at different points, may exhaust itself in a number of local outbreaks. Under other conditions a single case suffices to produce an extensive epidemic, a raging pestilence.

7. In 1848 it is recorded of the epidemic in Germany that the disease often attacked definite spots in the imported districts, a particular street, one side of a street, one house on one side of a street. In these respects it was considered to follow a similar rule as typhus fever, yellow fever and plague. Instances were also recorded in which the disease passed right through and across several streets "like a cannon ball," following, perhaps in such, the course of foul drains and old water courses.

8. The above so-called erratic characters of cholera are, no doubt, due to the operation of regular laws, the nature of which it would be important to determine.

IX. IN RELATION TO DIARRHŒA.

1. Diarrhœa may occur as an independent affection in times of cholera, or in connection with that disease. The attack of diarrhœa may pass off, or cholera, as such, supervene upon it.

2. Premonitory or choleraic diarrhœa differs in no apparent respect from ordinary diarrhœa. When it occurs, it seldom exceeds three days in duration in individual

cases, although, in some instances, it extends to a week, passing off or developing at the end of that time into true cholera. In regard to its duration of prevalence among masses of population, this seems to vary from a few days to several weeks.

3. It is considered that, in some instances, epidemics of diarrhoea have in reality been epidemics of cholera in that form. At Oxford, in 1852, deaths took place by diarrhoea without the case passing into the stage of developed cholera; yet they were looked upon as cases of the latter disease. Similar circumstances are noted in regard to other epidemics. Cases are recorded of persons coming from infected localities being attacked with diarrhoea within a certain number of days extending to fourteen from the date of their departure, but the affection undergoing no further development. When the more severe disease is introduced in this way into cities, its actual nature may remain for a considerable time undetected.

4. The Constantinople Commission accepts the axiom that an individual coming from a choleraic focus and suffering merely from diarrhoea, may propagate cholera in a healthy locality; in other words, premonitory cholera may transmit cholera.

5. It is also accepted as an axiom that the more severe the impending epidemic of cholera, the shorter is the period of premonitory diarrhoea.

6. Diarrhoea, in connection with cholera, is said to occur more often among the young than in elderly subjects.

7. It is said to occur frequently in the persons of attendants on cholera patients, and in them to take the place of the more developed disease. This circumstance was noted in connection with the epidemic of 1873 in Ottawa. It has also been observed elsewhere.

8. According to observations made in England, when diarrhoea connected with cholera, occurs in persons whose breath is habitually foul, and the state of their digestive organs offensive, the early stage of the affection is more infectious than that of clear, rice-water discharges of pure cholera.

9. In Scotland, in 1848, cases of diarrhoea to those of developed cholera were estimated to be as 60 to 1. In 1849 it is recorded to have prevailed in England for months before the outbreak of developed cholera. In the same year it prevailed on board *H. M. S. Apollo* with the cholera epidemic. In 1855 the occurrence of cholera among the French troops at Constantinople was preceded for some days by diarrhoea. Among the British forces in the Crimea, although diarrhoea prevailed in the mass before the occurrence of cholera, yet, in individual cases, it did not merge into the latter. At Malta, both in 1850 and 1865, it prevailed among the civil population prior to the outbreak of the epidemic, becoming more severe in type the nearer the time came to that occurrence. In 1869 diarrhoea preceded the occurrence of epidemic cholera at Kiev. In 1873 it prevailed externally in America, not only before but during epidemic cholera. It was reported as especially prevalent in Washington county and in North America.

10. With regard to India, the prevalence of diarrhoea among the troops at Secunderabad was remarked on 20th May 1871; cholera attacked them on the 24th of that month. It is recorded that all persons who, on the latter date, were attacked with cholera, had had premonitory diarrhoea, and that persons who on the 24th escaped developed cholera, were seized with diarrhoea.

11. But although diarrhoea is often found to precede cholera, this does not seem to happen invariably. It is recorded that such did not occur in reference to the

cholera epidemic in Madras in 1848. In the French epidemic of 1855, the occurrence of diarrhoea is mentioned by 97 reporters, while 15 others allude to it as exceptional. Our troops in the Crimea were, in many instances, seized with the collapse of cholera without any premonitory symptoms. It is recorded that at Gateshead, in the same year, 55 persons who went to bed in perfect health on the night of 25th December, were attacked before sunrise of 26th, and of the number 32 were dead before sunset. In 1876 diarrhoea and other premonitory symptoms were, for the most part, absent in the epidemic among the British troops at Mean Meer. At Peshawur in the same year the attack of cholera in the 42nd Highlanders was sudden and not preceded by premonitory symptoms. During the Indian epidemic of 1872, in the greater number of places where it was severe, diarrhoea also prevailed during its continuance. At some stations however, notably Murrec, it was absent. It is stated that during the epidemic of 1873 in Cincinnati, diarrhoea was absent.

X. IN RELATION TO "EPIDEMIC CONSTITUTION."

1. It has been observed from time to time that during the prevalence of cholera in a locality, persons who, although they escaped the actual disease, have suffered from greater or less derangement in their normal condition of health. To such derangement the name of "epidemic constitution" has been applied by some writers.

2. Thus, prior to the outbreak of cholera in Malta in 1865, and throughout its duration, there was a prevalence of malaise, with a sense of coldness in the epigastrium, irregularity of the bowels, flatulence, spasmodic action of the muscles, timidity, darkness under the eyes, and a sense of general depression. Instances of somewhat similar nature are recorded in connection with the epidemic of 1873 in

America. The actual attack was often preceded by a distinct stage of malaise, lassitude, borborigmi, sense of fatigue, and so on, the duration of these being in some instances five days. These indications, which affected all classes of persons, were noted particularly in Chatanooga and Indiana.

3. Nor is it only in recent times that the existence of this so-called epidemic constitution has been noted. At Arcot, in 1787, a feeling of general oppression and indescribable sensations, cold pervading the body, and want of appetite are recorded as having prevailed at the time cholera, as an epidemic, devastated that place.

XI. FOCI OF CHOLERA.

1. Foci of cholera are described as primary and secondary. The former are those into which the introduction of the disease from without cannot be traced, but from which it diffusion takes place; the latter are those into which its introduction is traceable, and from which it subsequently radiates.

2. As examples of the first, it is observed that in 1861 cholera in India seemed to originate in several independent foci, from each of which it spread. The general epidemic of 1865 spread from two principal, the one in India, the other in Jeddah. Similarly that of 1869 in Russia and Persia occurred in places far apart from each other, the intervening spaces being free until more or less visited by the disease in its diffusion from those points. At Lizton Indiana, in 1873, there is said to have existed no evidence that the disease had been imported. It seemed to have sprung up there, although, as observed in the report of the circumstance, the special cause may have been imported.

3. As illustrating the second, it is observed that in 1865 the disease having been imported into Mecca by means of pilgrims from India, it followed caravans to Alexandria, and thence radiated with human currents to Beyrout, Sapienza, Constantinople, Malta, America and Marseilles, all of which cities became in their turn so many foci, whence it further spread by the great highways of communication. In 1867 the Indian epidemic spread in all directions from villages into which the disease was introduced by pilgrims from Hurdwar.

4. It is asserted that in either case, danger of propagating the disease exists so long as one of the foci remains, and that no direct means have yet been discovered of extinguishing such foci, whether they be primary or secondary. It is added, however, that hopes are entertained Hygiene may ultimately do so.

5. How far the theory of foci is really based upon actual conditions in respect to the origin of epidemics, is an important subject for investigation.

XII. IN RELATION TO LOCALITIES.

1. That some localities are more liable to be visited by cholera than others is generally allowed to be the case. The influence of locality is in fact, considered necessary to the production of cholera, and cannot be excluded from the list of exciting causes. The precise nature of that influence however, has yet to be defined. Places and parts of places are thus visited in repeated outbreaks of the disease. It has been so in Ghent, Nimeguen, London, Breslaw in the south of France, south of Germany and Italy. In India the disease is considered thus to attach itself to Goa and Surat, to the Malabar and Coromandel coasts, to Bengal, Calcutta, Bombay ; and at times to Java. In some

of these it seems to recur at particular seasons, at other times without reference to them. At military stations in India, one body of troops or locality may be visited while others escape; those that escape in one epidemic or part of one epidemic being visited the next. In India and in western countries, cities and towns may be affected to the exclusion of country places.

2. The disease was considered to be thus localized at certain points of the course of the river Ganges. One such point extended from Monghyr to Bhaugulpore. Troops in former days passing through this tract by boats seldom escaped without some of their number falling victims. So in regard to the vicinity of Sherghotty, in Bengal, troops in marching along the grand trunk road in former days seldom escaped cholera there.

3. It is observed that in many instances cholera is more severe in localities that are themselves depressed than at such as are more elevated. This is the case at Elichpore and Duriapore, as compared with the neighbouring highlands. In the city of Nashville the epidemic of 1873 was confined to the low parts, the higher almost entirely escaping. Similar instances are recorded regarding other places, although there are also numerous exceptions.

4. The pertinacity with which cholera clings to camp grounds in India is well understood in that country, and special regulations instituted with regard to it. Instances are recorded of the malady during epidemics on the continent of Europe clinging to a particular portion of a town, and not being conveyed thence to others by changes of residence among the inhabitants.

XIII. IN RELATION TO GEOLOGICAL CONDITIONS.

1. It has been stated that cholera is less prevalent where the formation is of laterite than upon rocks and soils of other kinds; more so in clayey and ill-drained localities, and most fatal of all upon "black cotton soil." It is recorded to have been absent from the volcanic formations of Auvergne in 1832, although prevailing in the districts all around; and in England to have been less fatal on primary rocks than on others.

2. Such exceptions are by no means constant. It has at different times appeared on rocks and soils of the most opposite characters; upon alluvium, laterite, sandstone, trap and other primary formations. On the one hand, while Honore, in the Madras Presidency, is exempt from cholera, from the circumstance as is asserted of its being surrounded by a broad belt of laterite, there are on the other several places in Bengal the base of which is laterite and where cholera rages with peculiar violence. Among them are Midnapore, Soorie, Bancorrah. Similar remarks apply to several places in Orissa and the Deccan. According to jail Returns from Bengal cholera is said to have been more prevalent on laterite than on alluvial soil in the ratio of 2·64 to 1·13 per cent. The range of hills between Orissa and Nagpore, the natives of which are said to be exempt from cholera, is composed of metamorphic rock. The island of Bombay where cholera is endemic is metamorphic, the native town upon alluvial soil Calcutta is on alluvium, the delta of the Ganges consists solely of that deposit.

3. It is considered that a rock which itself contains no elements injurious to health, may be placed in such physical conditions as to become a store-house of malaria.

4. The circumstance has been observed that in England cholera has prevailed with peculiar violence and fatality in the coal districts. In the district of Raneegunge in

Bengal, also of carboniferous deposit, the disease is considered to be similarly violent and fatal. During the American epidemic of 1873, it is recorded that in parts of Paducah built over gravel, few cases occurred, but that in alluvial soil it was virulent; that Knoxville Ten: a favourite haunt of cholera, is underlaid with lime formation, its water springs laden with lime salts.

XIV. IN RELATION TO PHYSICAL GEOGRAPHY.

1. It has been asserted of cholera that it has prevailed on all soils and in all climates; on islands, coasts and deltas; on plains a thousand miles from the nearest sea coasts; in districts of as various geological characters as the alluvial deltas of Indian rivers and in those of volcanic formation. Some writers assert that cholera prevails with greatest severity in countries that are surrounded by mountains, and abound in lakes and marshes. Poland and Hungary are quoted in illustration. In the former, during the epidemic of 1831, of 1000 population the ratio attacked was 57, died 21; of the latter 51 and 22 respectively.

2. It is recorded in relation to the epidemic in France of 1855, that it affected districts the most diverse in geological characters and degrees of elevation. On the other hand cholera has been said to make little impression in mountainous countries through which streams pass rapidly, where no stagnant or retarded waters exist, where the formation is rocky, and the soil sandy. Silesia and Prussia generally possess these characters, and in both cholera has been comparatively light.

XV. IN RELATION TO THE SOIL.

1. From times far back in history, a connection has been supposed to exist between the nature and conditions of soil and the diseases that prevail among the inhabitants of a particular locality. During the war in Germany, between 1742 and 1750, the principal Medical officer of the English forces operating in the Low countries, expressed his opinion that, "by looking into the wells, it is easy to determine the healthiness of villages. The lower they become, the more the emanations from them are indicated."

2. Of late years a somewhat similar theory has been promulgated. A porous alluvial soil, easily permeable by water and air, saturated with excrementitious matter and impregnated with cholera dejections, becomes, it is said, first a receptacle, and then, under certain circumstances, a focus for the dissemination of the principle of the disease. Damp soils are favorable to the disease. In them matter is rapidly decomposed, and on the surface being disturbed cholera may break out. This has been observed to be particularly the case in China. Cholera and fever often occur in places, the soil or rock of which has been opened up. It is so also elsewhere.

3. Continuing the formula, it is further observed that the activity of the choleraic dissemination depends upon the level of the water beneath the surface of the soil, that is, upon the greater or less humidity of the superficial stratum of the soil; that when the water recedes and a certain degree of dryness succeeds unusual humidity, such a condition becomes most favourable for the development of cholera.

4. It is considered there are grounds for believing that the soil alone of places in which cholera is endemic, becomes the receptacle of its germ, and has the power of preserving it so long as to permit of its being incessantly

evolved more or less actively without the constant evolution tending to exhaust it before it can be renewed. In this way the obstinacy of the disease in some localities, the apparently spontaneous appearance of it after a more or less complete disappearance, may arise from the capacity of a particular soil for the reception and retention of the principle.

5. It is accepted as a fact that the soil upon which an assemblage of persons among whom cholera prevails have been encamped, may transmit the disease to healthy persons subsequently encamping upon it. Also, that the readiest method of destroying the influence of the contaminating principle is to bring the locality under cultivation. It would be a matter of interest to ascertain how far the agricultural labourers engaged in the operation are affected by the disease.

6. On the other hand, the International Commission expresses the opinion that cholera has never been originated by the nature of the soil. This is only one of several conditions necessary to the development of the disease. It is a known fact that the disease occurs in places the opposite in character to those above enumerated, the theory in such cases being that when it does so, their conditions also are favourable for the development of the disease.

7. With regard to the theory in connection with surface water, it is observed that the theory may be true for Munich (where experiments took place) to a greater or less extent, but they have certainly failed to explain the phenomena of the rise and fall of epidemics in other places. As to the conditions at Munich, where observations on this subject were conducted, they are thus described : "The well in every house is in close proximity to refuse pits and drains ; natives avoid the water as a drink and warn visitors against it. The streets extend to an old cemetery

in which whole generations are buried; the air of the locality is tainted, the water polluted. What Munich wants is pure water." In India no confirmation of this theory has yet been obtained in the history of epidemics, nor have the experiments instituted disclosed other than negative results regarding it. At Halle, in 1866, the level of ground water had no effect. During the epidemic of 1873, in the United States, observations indicated no connection between the oscillations in level of subsoil water and the prevalence or decline of cholera.

8. As to the statement often made that the black cotton soil of the Ceded Provinces has a connection with the virulence of cholera epidemics in districts where it exists, there are authors who deny this connection, observing that there is nothing in that soil that harbors cholera or favors its reproduction.

9. It is asserted that organic matters in passing through a bed of soil, fourteen metres thick and one-third full of air, have their carbonaceous and nitrogenous constituents fully oxidised, and appear in the water in the form of the products of their combination. It seems that the passage of such matters through this depth of soil requires at least six days.

XVI. IN RELATION TO RIVERS.

1. Cholera is considered to have a tendency to occur in river deltas, in localities inundated by their periodical rise, to be attached to river basins, to prevail on some occasions along and extend from either bank; in others to be restricted to one, to ascend along their course on some occasions, to descend on others.

carried the disease either to Egypt or to Syria, if proceeding by the Damascus route. In effect, however, this statement is to be accepted with caution. In 1859 cholera arrived at Mecca, and committed great havoc in the returning Damascus caravan.

3. It has indeed been asserted that on two occasions cholera has been introduced into Egypt by caravans of pilgrims from the Hedjaz. On 23rd May 1865 cholera is said to have existed in a convoy of pilgrims proceeding from Suez to Alexandria. Between that date and July 23rd the disease had destroyed 4,000 persons in the latter city. The first case occurred in Alexandria on 2nd June, and by the end of the month nearly all the towns in the delta of the Nile had been attacked. On one occasion, however, communication by sea was traced to have taken place with an infected port, and cholera had appeared before the arrival of the caravan.

4. In 1829 cholera was imported into Orenberg from Buchará, these places being separated from each other by a desert more than 160 versts in extent. Actually, however, the tract is a succession of steppes rather than desert. In 1860 large tracts of country in Upper Bengal were temporarily converted into deserts by the prevailing drought, and cholera ceased to prevail in them. With the occurrence of heavy rains in 1861 it reappeared and spread extensively.

5. The result of information so far as it has been obtained, seems to be that the present question demands further consideration.

XIX. IN RELATION TO HILLS AND MOUNTAINS.

1. No records appear to exist of cholera having in early times visited hill stations in India. A mountain barrier seems still, as a rule, to offer an insurmountable obstacle against the progress of epidemic cholera. The Himalayas and

Western Ghats are said to have done so on several occasions. In 1870 the epidemic travelled down to Cape Comorin, then turned round and progressed upwards along the Western Coast. The previous epidemic of 1869 had not passed the Eastern Ghats. In Africa, so far as is known, cholera has not surmounted the mountain chain of the lake districts in the interior.

2. But it has been observed that cholera rages with peculiar violence along the base of such barriers. It has done so at the foot of the Himalayas and at the Ghats near the Malabar Coast.

3. There is some reason to believe that the effectiveness of mountain ranges as a barrier is on occasions relative rather than absolute. In 1818 cholera extended from the plains of India to Nepaul, while in the same year from Kotah the epidemic does not appear to have crossed the Aravulli mountains. In 1846, in order to pass from Tiflis to Stavropol, it traversed the Caucasian chain at an elevation of 7,000 feet above sea level. When the disease rages at Teheran, 3,500 feet above the sea, it spreads to the neighbouring villages on the slopes of the Elbruz at a height 6,000 feet, showing itself there in isolated cases and going no higher. The camp of the Shah, comprising 10,000 persons, was free from the epidemic at 7,500 feet, while at the foot of the volcanic peak of Dema Wend it raged violently.

4. In India the majority of hill stations have been visited by the disease, including Simla, Sobathoo, Kussoolie, Murree, &c., their elevation extending to 7,500 feet above sea level. Simla and Murree have indeed obtained of late years a very unenviable notoriety in this respect.

5. In France, during the epidemic of 1855, villages on hill sides and at considerable degrees of elevation suffered equally with those in deep valleys. A similar occurrence has been observed elsewhere.

6. In the Indian epidemic of 1833-34 the holy city of Bigginuggur, 1,600 feet above the sea level, was the home of cholera to a greater extent than any other part of the Madras Presidency. In the American epidemic of 1872 no case occurred in Cincinnati at a greater height than 175 feet above low water mark of the Ohio, that is, 605 feet above tide level in the gulf of Mexico.

7. As a rule, however, it is accepted as a fact that the disease prevails to a less degree on high and exposed localities than in such as are low and confined. In London, in 1866, the greatest mortality by the disease occurred at an altitude of from 10 to 20 feet, the next greatest at 20 to 40, the ratio diminishing without interception from the lowest to the highest altitude.

XX. HILL STATIONS IN RELATION TO AFTER LIABILITY.

1. The question has been raised, Do troops who have resided for some time at a station in the hills become more liable to attack by cholera when they descend to the plains than those who have not been in the hills?

2. It has been stated that when the troops from Kusowlie and neighbouring stations were in 1857 suddenly brought to the plains to proceed to the relief of Delhi, the men suffered from cholera and were otherwise less efficient than those of regiments that had remained in the plains. Also, that in 1869 the attack of cholera in the 58th Regiment at Allahabad was, without exception, confined to the wing which had shortly before returned from Darjeeling.

3. The question is one of great importance, and seems to deserve careful investigation. It has a very important

bearing upon that other difficult question, How best to utilise Hill stations with reference to the efficiency of the British forces in India.

XXI. RELATION BETWEEN CHOLERA AND OTHER EPIDEMICS.

1. Some writers assert that the occupation of a locality by another miasm, as that of small-pox or of marsh fever, is a circumstance antagonistic to cholera; also, that the advance of such an epidemic induces the disappearance of cholera. Other writers adduce instances where an epidemic of the one nature has preceded, accompanied or followed one of the other.

2. The diseases more particularly alluded to are military fever, fluxes, influenza, typhus fever and small-pox. In its unequal and often partial distributions, cholera is said to resemble influenza more than any other disease. Both travel along a definite course in spite of opposing winds and variations of temperature. Both for the most part extend from east to west.

3. During the epidemic of cholera in France in 1855, it is recorded that in some parts of that country, more especially the Haute Saone, neither had epidemic cholera any effect upon the prevailing diseases, nor had they any effect upon it.

4. It has been observed in India that epidemics of cholera and of small-pox at times alternate with each other.

5. During the sixteenth century and since that period a belief has existed in the connection between cholera, dysentery and fever. In 1620 the two former prevailed together in the French fleet at Sumatra. In 1768 and

1771 fever and flux are recorded as having prevailed together in the Bengal Presidency, the latter having a cold stage lasting twelve hours. In 1829 in India the presence of cholera in India modified, for a time banished the ordinary epidemics of the country. In 1853 the epidemic of cholera in Calcutta was often succeeded by a form of typhoid fever. A similar circumstance had on former occasions been observed among the troops in Lower Bengal. In 1855, cholera in France prevailed in many places in connection with miliary fever, the latter being indeed described as "cutaneous cholera." In other departments of the country it was accompanied by diphtheria of the mouth. In 1869, prior to the outbreak of cholera at Madras, an "unhealthy wave" seemed to be passing over the place. Sores and ulcers in the General Hospital assumed a glazed unhealthy appearance; stumps became sloughy and gangrenous. It is observed that no diarrhoea prevailed at the same time. In 1873 the advent of cholera in Alabama was preceded by intestinal disorders of several kinds, including diarrhoea and dysentery.

6. The sudden and fatal character of cholera has made the disease appear as if it were more mysterious than any other disease. In reality it is as difficult to account for the spread of any other disease as; for example, malarial fever, small-pox or scarlatina as for the diffusion of cholera.

XXII. IN RELATION TO FEVERS.

1. A close analogy has been described as existing between the phenomena of cholera and those of intermittent fever; the stage of collapse of the fever has been observed to pass into the stage of collapse of cholera; cases of cholera to present black vomit, and characteristic tinge of yellow fever.

2. In India the outbreak of cholera has frequently been preceded by the prevalence of fever; and as the epidemic of cholera became milder, the symptoms in individual cases assumed the characters of remittent fever, then of intermittent. It has been stated that where native troops have suffered most severely by cholera, they have also been most subject to fevers; where they have suffered least from cholera, they have also suffered least from fevers.

3. There are examples, however, of cholera being altogether absent in seasons of prevalence of fevers in endemic areas. In 1869 fevers prevailed in the Kistna and Godavery districts, yet cholera was absent.

4. A striking difference between a case of intermittent fever and one of cholera is that of temperature. In cholera it descends below the natural standard more than in any other disease. In the stage of collapse it descends to 96° F., in that of reaction it ascends to 102·5° F. In intermittent fever it is increased even during the cold stage of that disease.

5. In 1575 it was asserted that deaths by cholera were usually associated with double tertian ague. In 1677 at Goa cholera was described as associated with fever. At Minorca in 1742 to 1750 it is reported to have specially attacked persons in the cold stage of ague. In 1788 cholera was described as being "sympathetic" in intermittent and remittent fevers. In 1816 low fevers and various pestilent diseases prevailed in Bengal, especially malignant sore throat, bilious remittent fever, &c. In 1818 cholera and fever prevailed together at Ganjam; at Maligaum the same year, when cholera declined, a malignant bilious remittent became very prevalent. In 1835, when cholera prevailed in the British regiment at Ghazepore, the epidemic was succeeded by fever. In 1844, at the same station, the 29th Foot suffered from fever, the attacks attended by a degree of prostration resembling the collapse of cholera; and at

Meerut it is reported that severe attacks of fever in men of the Buffs often ended in cholera. In 1848 in England and Scotland many instances were noted where cholera occurred chiefly in the haunts of typhoid and typhus fevers. At Ghooty in 1869 fevers prevailed at the same time as cholera. In 1872 the first case in the 18th Hussars at Secunderabad occurred in a patient ill with ague, and at the majority of places in the Bengal Presidency, more especially Allahabad, Meerut, Meean Meer, Mooltan and Peshawur, fever continued to prevail after the cessation of the cholera epidemic. In 1873 and 1874 remittent fevers prevailed in America, attended by collapse resembling cholera. In some of these actual cholera occurred; in others it did not.

6. At Malta, in 1848, fevers and bowel complaints became suddenly aggravated in prevalence and severity before the outbreak of cholera on that island. At Peshawur in 1869 cholera and fever prevailed severely, the fever making its appearance before cholera, continuing through the epidemic of that disease, and persisting after its disappearance. A similar occurrence was also observed at Umritsur and some other places.

7. The fever epidemic in the above instances was not confined to the area of cholera, nor did the latter epidemic visit all the places where fever prevailed. At Rawul-pindee no cholera occurred in 1869, yet the troops suffered severely from fever. Similarly also at Meean Meer and Jullundhur.

XXIII. POINTS OF SIMILARITY BETWEEN CHOLERA AND SMALL-POX.

1. A comparison between cholera and small-pox has by some writers been drawn after this manner. Like small-pox, so with cholera, after a season of unusual devastation both *die* away. The one disease is stated to be very

contagious, the other but slightly so. Both have a specific poison. Both are seldom entirely absent from Calcutta. Both prevail at particular seasons. Both become epidemic at intervals. Both often rage together or at the same time in different localities. It is obvious that these points of similarity have reference more to the laws which regulate their diffusion than to the nature of the diseases themselves.

XXIV. IN RELATION TO MALARIA.

1. Cholera has been attributed to a special miasm of a nature akin to malaria. In regard to the French epidemic of 1855, it has been observed that in some malarious localities it presented some of the characters of paludal fever; in others that it co-existed with that disease.

2. On the other hand, on that and other occasions several paludal regions escaped cholera completely. In North America, in 1849, at none of the malarious localities did cholera occur until after the arrival of persons from infected districts. International Commissioners express the opinion that no connection exists between cholera and ordinary miasm. It is observed that on the banks of the Ganges there is no proportion between the intensity of a malarious and of a cholera epidemic; each has its own peculiarity and reaches its climax of intensity at a different season of the year. Malarial disease rages on the spot; the principle by which it is produced does not re-develop itself in man, and consequently it is not capable of being transmitted. The converse holds good in regard to cholera. It extends in all directions, its principle being re-developed as subjects are in succession attacked by it.

3. It is recorded of the American epidemic of 1873 that in Lexington Ky, as cholera disappeared it was succeeded by dysentery and fever, both of malarial origin. It is added that, "If asked why cholera is not unfrequently produced in

malarious districts during the hot weather, we cannot tell ; nor why in some places remittents occur one year, intermittents another, then dysentery, and so on?" Does it then follow from such remarks that a connection between cholera and malaria was considered to exist?

XXV. DIFFUSION OF CHOLERA.

1. Prior to 1817 cholera appears to have been restricted in regard to its origin within the limits of India. Since that date it is considered to have acquired an expansive character which it did not possess before. In reality, however, this expansive character is old as the first accounts of the disease. It was exported from India in 1543, and since then extended from time to time to Europe and elsewhere.

2. A *name* has been introduced to indicate this character of the disease ; some writers have called it *Invading Cholera*. No difference, however, between the actual disease of the present day and that which from all time seems to have existed in India has hitherto been defined ; the diffusion of the disease is not considered to be due to any new quality acquired by cholera ; the International Conference has therefore decided that the expression "*Invading*" is superfluous.

3. Diffusion of the disease may be restricted within certain limits in India. The epidemic of 1871 was so, the particular areas being by some writers considered to have been uninfluenced by facilities of communication between them. The epidemic of 1873 extended along the Mississippi from New Orleans, but did not become general ; it was a local outbreak, confined almost entirely to the valley of the great river. It may spread far and wide over various countries. In Europe it has exceeded to Lat.

64° N., but apparently not beyond. In America it has spread from Mexico to Canada, the West India Islands and to the interior of the continent.

4. It may continue to a certain point and there cease, without the presence of any particular circumstance capable of explaining why it does so. It is recorded that in 1632 the natives of Goa had a belief that the disease having extended from India over Persia, Syria and Egypt, disappeared in the African desert. In 1823 the epidemic which reached Russia from Persia, died out at Astracan; that of Syria died out at Damascus. In 1829 the epidemic extended from Bokhara across the steppes of Tartary to Orenberg and there died out.

5. It is observed that nowhere has the diffusion of cholera taken place more rapidly than the rate at which communication occurs between different localities. In numerous instances this is no doubt true, but is it so of all? The history of the epidemic of 1832 in Paris, that of 1846 at Kurrachee, and of others in and out of India, indicate that there are instances in which the theory of diffusion of the disease by human intercourse, so far as intercourse can be traced, fail to explain the occurrence of the epidemic in a particular locality and its spread beyond it. Prior to the outbreak in Paris that city had been in constant communication with Germany, Holland and England, in all of which the disease had prevailed for upwards of a year. Perhaps, however, the early cases may have been overlooked. So also in regard to the theory of emanations and contaminated water, they are of themselves insufficient to explain the diffusion of the disease.

6. Diffusion or spread of cholera does not take place uniformly. The disease when epidemic seems rather to extend from particular centres; often passing over places, even villages and towns, or subsequently attacking them. Places visited by the disease in one epidemic are often

visited by subsequent outbreaks; others are for longer or shorter periods left exempt.

7. Isolated cases of cholera occur in localities far apart. When they give place to the disease in epidemic form, it is considered that the tendency of the disease is to attain its climax in all of them about the same time. Thus in 1837 isolated outbreaks of cholera occurred in Mexico, in Italy, at Marseilles, Berlin, Prague, Coventry, and on board the *Dreadnought*, the *Iphigeni*, moored under the very stern of the latter, remaining free. In 1856 the epidemic prevailed simultaneously in Northern India, Brazil, Cape de Verde, south of Europe, Russia and Sweden. Its sudden appearance in Northern Bengal in this year, without any visible cause, at isolated points, might, it was said, be likened to the seed which a bird drops in its flight, and which germinate where they fall. In 1867-68-69 it seemed to affect groups of localities in Russia, some conterminous with each other, some isolated. In 1869 it appeared simultaneously in places at some distance from each other in India, as at Jounpore and Gorruckpore. In 1871 the extension of the epidemic to Europe was traced to importation from Asia, yet it was only when the disease began to spread in Russia that it also extended as an epidemic through Persia and Arabia.

8. It has been customary to observe that, in order that cholera may extend and propagate itself, in other words become diffused, it is necessary in all localities other than those in which it is endemic, that *circumstances* should exist favourable to its transmission. What are those circumstances? Are similar conditions met with in all instances of diffusion?

9. Can the progress of diffusion be checked by any means yet discovered? The decision which holds good is, that once cholera has developed into an epidemic, no human means can stop its progress. The stoppage or cessation of

the epidemic is said to depend upon the diseases being eradicated, or becoming unable to propagate itself. Why, or how these conditions happen, seem to be points yet to be ascertained. Neither is the precise value of such expressions readily defined.

10. The diffusion of the disease in France in 1855, although in some instances along the great thoroughfares and rivers, took place, in others in such a way that it was declared impossible to follow it. On that occasion the disease sometimes appeared in a particular locality, confining itself to a small number of persons, and then disappearing; in others it increased in violence and spread in different directions from particular points. In India, the epidemic is described as extending over the country, apparently so capriciously, that it was declared impossible to say whether it was propagated along the main lines of communication, extended by means of the prevailing winds, or in what other way it became diffused.

11. India however, labors under several disadvantages in regard to means for obtaining correct information in reference to epidemics. The mass of the population move from place to place; they either take little notice of the existence of the disease among other castes than their own, or observing it are unaware of the importance of communicating correct information. In many instances also moving masses may themselves be the means of propagating the disease, perhaps without being aware of the fact.

12. Cholera has never appeared in America except after Europe had been first attacked. It has never occurred in the west of Europe, unless the eastern part of the continent had been previously under its influence; and not in the East unless connected with an outbreak in Turkey in Asia, Arabia or Persia.

13. In 1817 it has been shewn that cholera was brought to Jessore from without. In that year it is believed to

have "broken out" in remote places at such short intervals of time, that its general diffusion *must* have been owing to some more general operation than infection or contagion proceeding from one spot alone. It travelled down the coast of India, often in opposition to a strong current of wind, but along the track of human intercourse. In 1818 it was looked upon as capable of being transported from one place to another, and also to possess the power of propagating itself, "subject to natural laws with which we might never become acquainted." In that year it was observed that several families became simultaneously attacked by the epidemic.

14. In relation to the approach of the disease to Orenburg in 1829 and diffusion therefrom, the result of observations was stated to be that it was not communicated by the winds; now and then it seemed to *skip* over many villages, and to leave large tracks of country untouched. It followed highways, attacking towns which, although more distant than others, were on account of their size or commerce more likely to be the resting places of travellers.

XXVI. DIRECTIONS OF PROGRESS.

1. It is generally asserted that epidemics of cholera originate in the east and travel westward. Neither in the east nor in the west is the rule constantly applicable, if indeed there be a rule. In 1781 the disease as an epidemic travelled from Ganjam to Sylhet, *i. e.*, north-east. In 1794 nearly south from Marwar to Thanna, on one occasion going from the coast to the interior, on another from the interior to the coast. The several epidemics which have since 1817 extended from India to Europe have never followed the same route on two successive occasions. In 1818 cholera travelled from Bengal to Madras along the

coast line, and also through the Central Provinces. It progressed in Bengal upwards along the Ganges and Jumna towards Agra, Delhi, and Hurdwar, meeting in its progress a stream of the same disease that was in progress downwards from the latter place. In 1832 cholera was carried down along the Mississippi. In 1833 it reached the United States by a different route from what it did in 1832, but was carried northward along the same route of travel as on that occasion. In 1844, while one current of the disease was extending westward from Bokhara to the north-east of Persia, another was progressing from the Punjab eastward to Delhi. In 1848 the epidemic reached India from Central Asia, to which in 1840 it had extended from China. It has at different times advanced via Bombay and the Deccan, travelling southward and passing to Ceylon—a period of two years being occupied in its diffusion. In 1865 to 1868, the general direction of the disease in Persia was from west to east. In 1869 it travelled from Bengal N. W. to Cabul, S. to Cape Comorin, S. E. to China, and W. through Africa. It spread simultaneously from Kiev N. E. to Moscow and Nijni Novgorod down the Dnieper to Odessa; from Moscow N. W. to St. Petersburg, and thence S. W. to Warsaw. In 1870 it was described as extending in such a manner that it was not easy to determine its precise directions. In 1873, in the United States, the epidemic extended in all directions—north, south, east and west—just as the pressure of commerce, travel, or war propelled it.

2. The conclusion arrived at is, that cholera radiates in all directions. It is added that it does so according to the facility and multiplicity of the communications. That this is so appears to be established; but the explanation given is insufficient to account for the diffusion of the disease on all occasions.

XXVII. DOES IMPORTED CHOLERA NECESSARILY SPREAD?

1. By no means. An arrival from an infected locality is not of itself always sufficient to produce an outbreak of cholera in every place. Numerous instances in illustration can be cited. In November 1832, cholera was introduced into Charlestown, America, by the brig *Amelia*, but the disease did not spread. In 1848 it was conveyed to New York by the ship of the same name, but did not spread beyond the persons immediately attacked. In 1853 cholera was introduced into Arbroath from Dundee; it affected eight persons, but did not spread beyond them. In 1854 the ship *Medway* with troops among whom cholera prevailed, en route from England to the Crimea, put in at Malta; the troops were landed and quartered in the Lazaretto; 49 of them were attacked and 16 died, but the disease did not spread in the island. In 1859, it was introduced into London and Hull from Hamburg, but did not spread in either. In Dresden the disease being introduced in 1866, a partial outbreak only occurred. In 1867 the disease brought to Pooree by pilgrims did not spread, and yet that place is usually one of its hot-beds. In that year it was imported into Mussooree, 7,000 feet high, and after a few cases disappeared. It was also introduced into Nynee Tal, but immediately disappeared. At Kiev in 1869 cholera did not spread from the town to the neighbouring districts. In 1871 two cases of the disease were imported from Hamburg into Hartlepool, yet the disease did not spread from the latter place. At Simla in 1872 a case was imported, yet no other person was attacked. It has never spread from imported cases in the Shevaroy or Neilgherrie Hills.

2. There may on occasions be the most intimate intercourse with infected persons or places without bad result. An epidemic of cholera does not occur at every locality which may be infected by a cholera arrival. Neither dirt

nor any single element, not even the poison itself when imported, will produce an epidemic unless all the necessary factors are present. The mine may be charged with powder and yet no explosion occur until the spark applied on the spot, that is, *the local disposition* lead to the explosion. But unfortunately the precise nature of this *disposition* is unknown; neither can the circumstance of its presence or absence be determined by any actual indications.

XXVIII. RATES OF MORTALITY.

1. It is considered that when the disease breaks out in a concentrated body of men, it may, under exceptionally unfavourable circumstances, destroy 20 per cent of them. It is not known to have ever exceeded this number. It is said indeed that of 90,000 pilgrims at Mecca, Meenha, and Arafat in 1865, 30,000 fell victims to the epidemic. This estimate must, however, be considered more approximate than actual.

2. The rate of mortality varies in different epidemics, so does that of attack. Both are usually greatest at the commencement, less towards its subsidence. In Paris, in 1831, for example, of the first 98 cases admitted, 96 died. But there are exceptions to this rule. During the epidemic of 1865 in Spain, the ratio of mortality in several places was greater towards its end than at its commencement.

3. When 5 per cent of the population are attacked, the epidemic is considered to be of a very grave nature. In that of Constantinople, in 1864, this proportion was not attained. During the epidemic of 1852 in Russia there were cases in which more than one-third of the population were attacked,

and the mortality was at the rate of 80 and 90 per cent. In 1869 the 36th Regiment lost 15 per cent of its strength by cholera at Peshawur.

4. In India the rate of mortality varies considerably according to season. From April till September the general result gives 50·7 per cent of cases, from October till March 19·5. In some epidemics the rate of mortality reaches 70 and 80 per cent; in others 20 to 30. In England in 1832 it was 47; in 1848-49 it was 45; in 1853-54 it was 46 per cent of cases. In India an average of eight years ending in 1853-54 gives for British soldiers 40·74; officers 16·66; women 31·74, and children 39·16. In some instances the rate of mortality is even greater than this; in the 86th Regiment at Kurrachee in 1846, of 410 cases 238 proved fatal. Among native troops for long periods the rates are in Bengal 30·54; Bombay 33·06; Madras 42·91.

5. In further illustration it is observed that in the *Bufs* at Meerut in 1867 the rate of mortality was 85·7 per 1,000 of attacks. During the Indian epidemic of 1869 the ratio of attacks to strength among British troops was 16·4 among men, 16·3 among women, and 18·9 among children; the ratio of deaths to attacks respectively among those classes 63·5; 12·7 and 76 per cent.

6. In England it has been stated that the rate of mortality by cholera is three times greater on the coast than in the interior. If this be a fact there, it is not held to be so in India.

7. In France the rate of mortality has been found to vary in different epidemics, and at different places during the same epidemic. In some localities in that country the epidemic of 1854 was more fatal than that of 1832 or 1849, in others less so, while in respect to these two, similar variety was observed. This circumstance has also been noted wherever a history of cholera has been preserved.

8. With regard to America, it is recorded that in the epidemic of 1866 the general rate of mortality to cases was 1 in 2 28 among whites, and 1 in 2·05 among colored, taking the statistics of the military classes only. In the epidemic of 1873 the general rate of mortality to cases varied from 46 to 73 per 100, the average being about 50.

9. The degree of intensity of cholera, as indicated by the rate of mortality, is not necessarily in relation to its extent of prevalence. A small number of attacks may produce a large relative number of deaths ; in other instances a large number of cases may have a small proportion of mortality.

XXIX. IS THE RATE OF MORTALITY BY CHOLERA INCREASING ?

1. It is considered in accordance with Indian experience that the rate of mortality at some stations, if not all, increases the longer they are occupied by British troops. Such is the general impression. The following statistics may help to resolve the question.

2. As an illustration, Secunderabad is cited. There the disease had never, prior to 1871, been looked upon as formidable in relation to them. Since that date it has occurred with severity.

3. In Bengal, from 1818 to 1835, the percentage of admissions to strength was 3·25, of deaths to cases 26·36. From 1836 to 1853-54 the admissions were 2·62, the deaths to cases 39·75 per cent. In Madras, from 1829 to 1838, the deaths were 27 per 100 cases ; from 1842 to 1851-52 at the rate of 50. In 1819, in the island of Bombay, the ratio of the native population attacked was 7·5 per 100, of deaths to attack 64 ; but it is added, compared with yellow

fever, these rates are not so immoderate. Thus the rate of deaths to cases of the latter from 1801 to 1804 was at Cadiz 40 per 100, Seville 60, Vera Cruz 30 to 35.

4. Minute statistics in connection with this question occur in reports by Sanitary Commissioners. According to these, from 1818 to 1846 the ratio of attacks per 1,000 British soldiers in Bengal ranged from 21·6 to 39·7, the mortality from 5·7 to 13·5. From 1847, from 1·09 and 0·8 to 61·6, 33·03 respectively. Taking individual periods, that of 1818 to 1822 gave a ratio of 21·6 cases and 5·7 deaths per 100 strength; of 1828 to 1832, of 39·7 and 8·6; that of 1856-57 of 61·6 and 33·05; and that of 1867, the worst of recent epidemics, 20·09 and 13·84 respectively. As a point for comparison it is observed that in the English epidemic of 1849 the highest death rate according to population that was attained was equal to 241 per 10,000 living.

5. Between 1818 and 1853-54 the proportion of deaths to attacks among whites in India has risen from 26·7 to 42 per cent. in the Bengal Presidency; in Bombay from 18·5 to 45·5; in Madras from 27·1 to 62·3. Since 1861 the ratio of seven years gives 66·94 of deaths per 100 attacks, while that of the preceding six years gave 51·9.

6. From these facts, therefore, the conclusion arrived at is, that the ratio of attacks to strength has not of late years undergone an increase, but that the rate of deaths to attacks has very considerably increased.

XXX. NATURE OF THE CHOLERA GERM OR POISON.

1. The existence of a cholera germ or poison has been assumed, the terms *Cacozyme* and *Cholerine* being applied to define the undefinable.

2. For the most part it is allowed that we are ignorant of the nature of cholera poison. The most scientific and skilful men have searched for it in vain for the last forty years. Specific poison, microphytes, disease germs, vibrios, the excreta of cholera patients have, in their turn, been each and all accused. After careful chemical and analytical examination the result arrived at is, that there is no evidence of the presence in the blood of any particular poison. No special fungus has been detected in choleraic matters which had not also appeared in other media. There is no specific germ to be found in the atmosphere of localities where cholera prevails that can be connected with the production of cholera. No connection can be traced between the numbers of bacteriæ, spores, &c., present in the air, and the occurrence of diarrhœa, dysentery, ague or dengue; nor between the presence or abundance of any specific form or forms of cells and the prevalence of any of these diseases.

3. According to the decision by the International Conference, the nature of the generating principle of cholera has evaded all investigation; it is only known by its effects. In this point of view, they observe, it does not differ from other morbid principles. They add, "its nature is unknown"—"principles whose existence is an hypothesis;" but although the nature of the poison is unknown, it is hoped that its laws may be discovered. It springs, they say, from certain countries in India, remains there permanently; regenerates itself in man; accompanies him in his travels; is thus propagated to a distance, from land to land, by successive regenerations, but without ever reproducing itself spontaneously outside of man himself.

4. There are writers who take exception to the expression "Germ" or "Poison" and consider neither so suitable as "Influence." It seems that whichever term is employed, does no more than indicate an unknown principle.

5. It is further observed that the disease is only known to us as a phenomenon ; there is absolutely not a single jot of evidence to prove that there is a causative entity, a specific *something or other* which gives rise to the phenomenon. But whatever may be the nature of the causative principle, it is asserted that so long as it is kept in an acid medium it is innocuous, that this is the normal condition of the gastric secretions during healthy digestion in a healthy system.

XXXI. THE QUESTION OF SPONTANEOUS DEVELOPMENT.

1. The great bulk of opinion is against the *autochthonous* or spontaneous origin of the choleraic influence, whatever the latter may be. Like all infectious diseases cholera requires moving particles for its development and diffusion. It is asserted that such particles are derived directly or indirectly from man ; that the disease products are everywhere where man exists ; that they are therefore *anthropoethonous*, or as in the case of zymotic diseases which also attack animals, *zoöethonous*, that is, caused by transmission of infectious substances from living animals to other animals, or to man.

2. It is admitted that the special conditions under which the disease, cholera, originated in India are not known. The International Conference does not believe that the principle of the disease is generated *de novo* in the soil, or by the worst hygienic conditions, but considers that it maintains itself by successive transmissions, so that its germ is not destroyed. No degree of crowding, no special condition of the soil, nor any known circumstance has originated cholera out of its endemic area, or unless the disease has been epidemic. The same body express their opinion

that this principle never produces itself *spontaneously* except in the human frame, that true Asiatic cholera has *never* developed itself spontaneously, that its occurrence at sea without apparent cause is either from opening boxes of tainted clothes, or that the disease has existed unnoticed as diarrhoea. The Conference further observes that strict inquiry into the history of epidemics of cholera in Europe has always traced importation; also that the seemingly spontaneous origin of the disease in a locality after its more or less complete disappearance, may arise from the capacity of the soil for the reception of the cholera principle.

3. In 1831 cholera occurred with terrible violence among the prisoners in the jail at Sherghotty, no cause being traceable. In 1859 it occurred in a sudden and mysterious manner at Hamburg, at several towns on the gulf of Finland, at Mercia, on the Mediterranean coast of Spain, in Algiers and in Morocco. The fact of the occurrence of the disease in Paraguay in 1866 is important in connection with the present question and that of *endemic areas*.

4. The assumed spontaneous origin of the disease can be much better explained in most cases, in accordance with the well known fact that the virus often requires a considerable time for it to be developed. Thus, on the one hand, it is asserted that the occurrence of cholera at New Orleans in 1873 was spontaneous. On the other, that, judging from occurrences elsewhere, it was introduced by ships; that at the time of its outbreak the authorities were without information regarding the crews arriving.

5. It is asserted among other instances that so long ago as 1669 cholera occurred in London without being imported; that in 1831 no communication could be traced between Mussulburgh and infected places, yet that cholera occurred there with violence. At Lauffen in 1874 no trace could be obtained of the manner in which the disease was intro-

duced into the prison ; the first two cases occurred in prisoners who had been in prison respectively eight months and a year.

6. On the other hand, in America, from 1832 to 1848, no instance of supposed spontaneous origin bore the test of close examination, but always and everywhere it was found that the disease began after the arrival of persons or things from previously affected places. So in 1873 at Columbus it began in a habitation of public resort frequented by *railroaders* who from their vocation were apt bearers of the disease.

XXXII. DURATION OF ACTIVITY OF THE CHOLERAIC PRINCIPLE.

1. It is considered that the duration of the morbid activity of the cholera "germ" out of the human system if not exposed to air seems to be indefinite ; when exposed to air it is rapidly lost. When preserved in a dry place, the properties of the matter of cholera seem to be retained for years. When kept moist, they are steadily destroyed ; they are said to become oxidated.

2. Like other poisons or principles of certain diseases, that of cholera may retain its vitality in dry clothes ; also, it is assumed in particles of dust ; and in either condition no definite limit can be put to the period it does so. Thus dry earth may deodorise cholera matter, but preserve its properties so long as it is kept dry. An obvious danger is accordingly here involved.

3. Among instances in confirmation, a case which occurred at York is given. It happened in 1833, and in it the disease was considered to be directly traceable to infected clothing that had been shut up nine months previously, the

package in which they were so being then opened for the first time. In 1865, during the epidemic in France, a place occupied by a cholera patient nearly a year before, and meantime shut up, having been reopened, a death by cholera took place among its new tenants. Many others could be quoted.

4. But although under some circumstances, the nature of which appear to be unascertained, the choleraic principle may retain its activity, so may it also under unascertained conditions lose its activity or "die." Hence, according to some authors, the cessation of epidemics.

XXXIII. THE PERIOD OF INCUBATION.

1. The period of incubation measured from the date of reception into the system of the choleraic influence is considered to vary from a few hours to twenty and even twenty-seven days. As a rule, however, the period does not exceed eight days.

2. Numerous cases are on record of soldiers landing at Bombay, Calcutta and other Indian ports being attacked within a complete day after disembarking. In 1819 the 41st Regiment landed at Madras. Cholera attacked some of the men the following day. In 1822, the 54th Regiment landed at Madras from the Cape of Good Hope. Within three days cholera occurred in its ranks. When in 1831 cholera prevailed on the banks of the Medway, persons arriving there in perfect health from distant places were attacked in from sixteen hours to two days or a week. During the epidemic at Secunderabad in 1871, it is considered that the attack could not have exceeded two or three days after the reception of the choleraic "principle."

2. With regard to the average duration of the several stages of the disease, the result of statistics indicates that diarrhoea may scarcely exist or extend over twenty-four hours to several days; that collapse may end in death in twenty-four hours or be prolonged to eighty; that reaction may end unfavorably in forty-eight hours, or both in cases of recovery and of death may extend to weeks.

3. According to observations made in France, the duration of attack is shorter in young and in old persons than in the middle aged. At Malta in 1850 the average duration of fatal cases was 13·8 hours; in 1856 at the same place, of fatal cases, 29 hours, the extremes 4 to 120 from the first appearance of cholera symptoms; in cases of recovery 11 days, the extremes 4 to 24. In the Indian epidemic of 1867 many natives died within eight hours after their attack. In America in 1873, some deaths are recorded to have happened in two hours from the time of attack.

XXXVI. DEVELOPMENT OF EPIDEMICS.

1. The development of an epidemic does not take place spontaneously except in India. In all other countries, according to the majority of writers, it occurs after introduction from without. It may be gradual or sudden. At Meerut, in 1838, it broke out suddenly and with great violence. Collapse, a few watery evacuations and rapid prostration were followed by death in a few hours. At Kurrachee in 1846 and at numerous other places on various occasions the outbreak of the epidemic was preceded by cases of diarrhoea and of sporadic cholera. In France in 1855 cholera in some instances broke out with great violence, proceeding rapidly to death: in others it was preceded by diarrhoea and its development gradual. At Secunde-

rabad in 1871 the disease suddenly struck the 18th Hussars with great intensity, being confined to that regiment. In St. Clair county the American epidemic of 1873 burst "like a thunder clap," its origin being traced to some cases in the Railway Hotel at Lebanon.

2. An outbreak may take place at two or more places separated from and having no communication with each other; also in localities where importation is considered unlikely to have occurred. In England, in 1849, the disease appeared in a small number of spots, and increased by attacking a larger number of localities, it being often impossible to trace communication between them. Similar observations apply to other epidemics of the disease. In 1867 it appeared simultaneously at Hurdwar and Bijnore, separated from each other by the river Ganges; it seemed to originate in places far apart from each other, the intervening districts remaining exempt. In Jessore its origin was believed to have been due to strictly local causes, and according to the opinion of a Committee appointed to investigate the subject, the outbreak of the disease at Peshawur on that occasion could not be ascribed to Hurdwar pilgrims. It is elsewhere shown however, in these notes, that there is now every reason to believe the epidemic was introduced into Jessore from without, and that in regard to Peshawur more complete information could have probably traced a connection between its introduction into that station and returning pilgrims.

3. It has been asserted that three well known factors are necessary for the development of epidemic cholera, namely, certain conditions of the soil, of the climate, and individual disposition. It would be important were a definition given of the conditions in question. The mode in which the disease seems to become developed and to decline in a kind of regular order in a given locality, is as yet an imperfectly explained phenomenon.

4. In Alabama the conclusions arrived at in regard to the epidemic there of 1873 were, that local conditions of soil, peculiarity of climate, moisture of atmosphere, debris, animal or vegetable, will not of themselves produce the specific form of cholera, but that they are the hotbeds in and on which the cholera excretions having been placed, the poison is reproduced with fatal rapidity.

XXXVII. TIME OF SEIZURE.

1. The general impression is that the first seizure of a person by this disease takes place in the majority of cases in early morning. Statistics show however, that on this point no general conclusions appear to be warranted, beyond the circumstance that large numbers of patients suffering from the disease are, during epidemics, admitted in the morning and in the evening; also that the first attack occurs in nearly equal proportions at all hours throughout the twenty-four. According to reports of the four epidemics in France, the majority of seizures take place during the night.

2. It is recorded with reference to the epidemic of 1873 in America, that in Jefferson city, of thirty-seven cases not one occurred in the day time, twenty-one were before midnight, sixteen between midnight and daybreak. In the Ohio Penitentiary eight occurred between midnight and six a. m., ten between that hour and noon, four between noon and six p. m., and five between the latter hour and midnight. Elsewhere, in the same epidemic, it is recorded that the majority of attacks took place about three a. m., the patient suddenly awakening at that hour ill; again, in other places, that day and night were alike in regard to it.

XXXVIII. IN RELATION TO AGE.

1. According to some writers the foetus in utero has been found dead, its intestines containing the characteristic liquid of cholera evacuations. The presence of the malady in a pregnant woman is considered to tend to abortion. The disease is by many considered to be most fatal in children of under one year of age and under fifty-five. In India the result of five years' observation is said to be that all ages suffer alike from under twenty to thirty and upwards. In Malta, in 1865, the ratio of attacks and deaths is recorded to have increased with increasing age, the former to have predominated slightly in youth and old age. In India, in 1872, of 118 children who died by the epidemic, only one was under four months of age; the disease, on that occasion, was said to be comparatively rare during the two first years of life, but to be most fatal in children of from two to three years old.

2. It has been observed in America and elsewhere, that the greatest mortality occurs between the ages of twenty and forty years, that under one month fatal cases did not seem to happen, but that from that age to 108, deaths by cholera happened. In the epidemic of Lauffen, the age of least liability was from eight to twenty-two; from then till forty the liability increased; from forty the tendency to attack became rapidly greater.

3. In the epidemic of 1831 and oftentimes since then, instances have been recorded of infants at the breast being attacked after their mothers had died. In such, it may be asked, did the attack arise from contagion, or was it communicated by means of the milk? Some writers indeed assert that in the collapse of cholera the secretion of milk ceases. They cannot understand in such a condition where its watery elements come from.

XXXIX. IN RELATION TO SEX.

1. Cholera has been known to rage violently among, and be confined to one sex in establishments as at Bristol and elsewhere, containing male and female inmates under the same roof, separated only by partitions, breathing the same air, eating the same food, and using the same water, but resorting of course to different latrines.

2. According to statistics in India, the rate of attacks of cholera among soldiers is 1·74 as compared to 1·58 among soldiers' wives. In the epidemic of 1865, at Malta, the ratio of deaths to strength was greater in women than men up to the age of 45. After that period the ratios turned, old and worn out men giving most deaths. In the Indian epidemic of 1869, the ratio of attacks to strength was 25·7 for 1,000 in soldiers, as against 26·1 among their wives and families. In the epidemic of 1873 in America, males are said to have suffered more than females.

XL. IN RELATION TO HABITS.

1. It has been stated that in some epidemics cholera is altogether confined to the drunkard, in others, altogether to the temperate. The records of different outbreaks give varying results in reference to this point.

2. In an epidemic of the disease, described as having occurred in the French fleet off Sumatra in 1620, it was stated that living moderately, if it did not ward off an attack, at least increased the chance of recovery. In the epidemic of 1832, at Ceylon, it is recorded that of temperate soldiers attacked, one in six died, while of the drunken and irregular one in four succumbed. In the epidemic in Malta in 1865, sober men were considered to run less risk

of attack than the drunken ; also, while the rate of deaths to attacks were among the former 64 per 100, they amounted to 81 among the latter.

3. On the other hand, an Indian author of 1782 was unable to satisfy himself that the orderly suffered less by the disease than the disorderly. The Indian Committee on the epidemic of 1861, express their opinion that the intemperate were on that occasion no more liable to attack by cholera than the temperate ; but that when attacked they succumbed in larger proportion than the latter. In 1867, in the Indian epidemic, it is stated that of 793 men and women attacked, 744 were temperate and 49 intemperate. These expressions are only relative, but as such represent a certain value. In the epidemic of 1869, a vast majority of those attacked were men of regular and temperate habits. At Thyet Myo the same year the temperate suffered while the intemperate completely escaped.

XLI. IN RELATION TO STATE OF HEALTH.

1. The general result of observations is, that although previous debilitating disease doubtless predisposes to cholera, yet it is not rare to see very vigorous persons stricken down, while the apparently feeble escape unscathed.

2. To explain this circumstance it has been answered that vital resistance is in no way proportionate to muscular energy. As in many other instances however, so with such an axiom, there is difficulty in appraising its actual value.

3. In 1855 the outbreak among the French troops at Constantinople attacked chiefly the weakly *and the newly arrived*. The remark applies to recruits of low physique yet who were not in hospital.

4. More recently it is recorded that in the epidemic of 1867 in India, 708 persons attacked were in good health, 26 in fair, 103 in indifferent; that 8 were weakly, 13 in delicate health, and 52 in bad. In that year in the 90th Regiment a fatal epidemic of cholera occurred at Soobathoo. It had shortly before come from Peshawur, where the men had suffered severely from fever; at the time of the outbreak they were in a state of low health and cachectic. At Peshawur in 1869 the disease principally attacked convalescents from fever, diarrhœa and dysentery, invalids and time-expired men. In 1871 when the disease occurred in the 18th Hussars, its subjects are said to have been chiefly men of long service and those who had resided for some time in unhealthy barracks; and of the epidemic of 1874, in Lauffen, it is recorded that an excess of deaths took place among the weakly as compared to the strong. It has further been asserted that *post-mortem* examination has often shown the existence of previous disease of the villi and mucous membrane of the intestines. This statement, however, is believed to require confirmation.

XLII. IN RELATION TO SICK IN HOSPITAL.

1. The general conclusion arrived at is, that sick soldiers in hospital are nearly twice as liable to attack by cholera as are the healthy men in barracks.

2. In the Indian epidemic of 1861, the cases to strength in barracks were 4·7, the deaths to strength 2·9, and deaths to treated 62·7 per cent. In hospital among sick the cases to strength were 13·5, deaths to strength 10·6, deaths to cases 78·5 per cent. At some stations, notably Morar and Meean Meer, the proportions were even higher in both respects than those now given.

3. The rate of attack among the sick in hospital seems to vary in different years and epidemics. In 1861 it is stated that in Bengal 173 patients suffered by the disease ; in 1867, the number was 55.

4. It is recorded that during the epidemic in France in 1854, the greatest relative mortality occurred among the sick in hospital, and especially among the occupants of Lunatic Asylums. In 1873, of 291 cases treated in civil hospitals there, 101, or 35 per cent. occurred in patients. In 1865, of 120 attacks in the 22nd Regiment at Malta, 13 occurred in patients in hospital ; yet it is on record that the civil charitable institutions escaped almost completely, the orphanage and hospital for incurables completely so. At Breslau in 1873, of eight patients in a ward four became attacked with cholera. In the American epidemic of the same year, the sick in the Quarantine Hospital at St. Lewis were more fatally attacked than any other class.

5. In India, patients in hospital are often the first to be attacked on the occurrence of an epidemic of cholera. In that country as elsewhere lunatics are considered particularly liable to be so seized.

6. Although in the mass, sick in hospital suffer in proportion more by the disease than do healthy troops in barracks, it is related that in the epidemic which raged at Goa, in 1543, the disease attacked equally the healthy and the sick ; also, that in India, prior to 1817, it seized the weakly and the robust in nearly equal proportions.

XLIII. IN RELATION TO THE PUERPERAL STATE.

1. Cholera, when occurring in the person of a puerperal woman, is almost always fatal. Labor or abortion, as the case may be, invariably takes place during the stage of col-

lapse. The foetus is nearly always born dead. Cases occur in which abortion takes place soon after the occurrence of the attack of cholera, the subject surviving twenty hours afterwards. In others abortion has occurred without a sign, the foetus and placenta being discovered after death. In such instances dissolution had probably been accelerated by uterine hæmorrhage. Cases in illustration are recorded in the history of epidemics in France; also in regard to those in America as well as elsewhere.

XLIV. IN RELATION TO FEAR AND PANIC.

1. The occurrence of cholera inspires many persons with fear and panic; these in their turn predispose to attacks of the epidemic. It is also stated as a result of experience, that all depressing passions work a similar influence in this respect.

2. On the other hand, cholera is known on occasions to rage with great violence among classes of persons who are incapable alike of fear and panic. This applies to inmates of Lunatic Asylums.

3. Cholera seems in 1820 to have been introduced into Manila by means of ships from infected ports. The panic caused by the occurrence of the disease was great. The populace acquired the impression that the springs and fountains had been poisoned; they met in riotous masses and several Europeans were murdered.

4. During the American epidemic of 1873, it is recorded that in Texas grief and fear had a wonderful tendency to induce an attack. In some places *Choleraphobia* rose to a morbid condition. At Nashville a man thus affected jumped into bed; he had no vomiting, cramps or other symptoms of the epidemic, yet for a time he believed he

was affected by it. At Carthage many of the provinces were similarly seized with panic, yet it is stated that the timid were in reality not the greatest sufferers. Prisoners in India and elsewhere are held to be very liable to panic in times of cholera, and scenes of desperation among them to be not unfrequent on such occasions.

XLV. FUGITIVES FROM CHOLERA-STRICKEN PLACES.

1. Fugitives may themselves become attacked in their flight to escape cholera, or soon after, and also be the means of introducing the epidemic into places previously healthy.

2. In the American epidemic of 1832 a lady left Philadelphia to escape the disease ; she proceeded to the farm of her father-in-law in a secluded part of Delaware, was there attacked by the disease and died, and from the spot the epidemic spread. On the same occasion, the disease broke out in Prescott on the Ottawa river among persons who had fled from Montreal.

3. In 1865 it is recorded that 35,000 persons fled in all directions from Alexandria ; also, that they carried cholera to Beyrout, Cyprus, Malta, Gozo, Smyrna, Constantinople, Ancona, Marseilles and other places. At Saint George, a village situated seven hours' march from Sulina, it appeared after the arrival of persons flying from the town, while Lete escaped, the inhabitants refusing to communicate with those coming from the infected locality.

4. In 1873 fugitives conveyed cholera from Chatanooga to Ottawa, and it is related that while they did so, they were not themselves affected by the disease until after their arrival at the latter place. It is recorded that 1,500 people fled from Chatanooga on that occasion, and that of

the number, twice as many ultimately died in proportion as among those who remained in that city. The conclusion drawn from this is, that fugitives while themselves unaffected, may be the means of propagating the disease, and only suffer in their own persons after the general outbreak has taken place.

XLVI. IN RELATION TO NATIVES AND FOREIGNERS.

1. Writers on cholera in India have observed that in the epidemic of 1769 at Pondicherry the natives were in proportion much less liable to the disease than Europeans. Subsequent authors, taking the histories of a number of epidemics, arrive at the conclusion that in the mass British troops suffer in considerably larger proportion by the disease than natives do. A similar circumstance occurs in regard to white troops occupying stations within the sphere of yellow fever.

2. The natives of the Rajmahal range of hills are said to enjoy immunity from the disease, yet British troops in transit through that district are recorded to run a very great risk of attack by the disease. The Hill men of Chota Nagpore also remain free from cholera so long as they continue in their own territory. When however they migrate to the plains, they become as liable to the disease as all the natives of those parts. It is asserted that natives of Nepaul serving in the plains of India suffer by cholera to even a greater degree than do the British. So also with foreigners elsewhere. It is recorded that during the epidemic in Persia in 1869 scarcely a negress escaped among those employed as domestic servants by the better classes in that country.

3. From statistics it appears that in 1869 at Lucknow while the deaths per 1,000 of the native civil population

amounted only to .64, those among the British were 31.2. Between 1845 and 1867 in Bengal the ratio of attacks to strength was among the British 89 per 1,000, the deaths to strength 53; among native troops 9.56 and 4.11 respectively. During the same period the ratio of deaths to attacks was, in the British 60.19 per cent, among the natives 43.02. At Kamptee an average of ten years gave 15.93 per 1,000 as the annual ratio among white troops, and only 3 among natives. At Bellary, the average of nine years gave 29.7 of British and 9 of native troops. The Madras returns generally give the natives as 21 and 10 per 1,000 respectively. The ratio of recoveries is said to be smaller in India among whites than among natives, deaths being in the former one in 1.6, and in the latter one in 2.08 to 2.3.

4. Numerous instances are on record of the epidemic prevailing in the British troops at a particular station, while one or more, or all classes of the natives continued exempt. In 1843 the 39th Regiment and white soldiers of the East India Company's Artillery suffered severely at Agra, while the native troops in close proximity to their barracks were very slightly affected. In 1848 cholera at Dinapore raged in the 80th Regiment and in the bazaar, while among the sepoys it was mild. At Shajehanpore in 1867 the British troops suffered severely, the sepoys slightly, but the native population severely. In 1869 the epidemic at Fyzabad was confined to the white troops, the sepoys, prisoners and native population escaping. At Secunderabad in 1871 cholera attacked one British regiment and some native residents; it passed over the other troops, native as well as English, and the civil population generally. Having ceased however, in the 18th Hussars, to which it had been at first confined, it prevailed among the native population of the town. At Lucknow, in 1872, the British troops suffered, the sepoys and native followers escaped. Throughout that epidemic generally, the whites suffered more than the natives.

5. At Malta in 1865 the rate of attack per 100 among the native population was 1·6, of deaths to cases 62; among the military 2·9 and 72.

6. The greater liability of foreigners to attack, as compared to natives, when it occurs, is attributed to the natural law which holds good throughout the organic world, by which a deterioration follows the removal from the natural climate to one differing from it in any marked degree.

7. In regard to individual outbreaks of the epidemic however, it is observed that the immunity of foreigners in some instances, of aborigines in others, are circumstances of no rare occurrence.

8. It is recorded that in 1781 a detachment of Bengal troops marching down along the coast was attacked by the epidemic at Ganjam. The disease appeared first among the camp followers, then among the sepoys, and lastly among the whites. In August 1817 the disease was general among the natives in Calcutta; in September of the same year it attacked the whites; and during the hot season of 1818 it attacked natives and foreigners indiscriminately. At Bombay in that year it chiefly affected natives, especially recruits among the sepoys; few whites suffered from it. In 1827, while cholera raged among the native population of the North Western Provinces of Bengal, only two cases occurred among the white troops.

9. In 1868 cholera was very prevalent among the civil population at Secunderabad, to the exemption of the troops, native as well as white. The disease having recurred however, during the monsoon, several cases took place among the British troops. In 1869 it prevailed at a considerable number of stations in the Bengal Presidency, affecting sepoys to the almost complete exclusion of British

soldiers. At other stations, native troops almost completely escaped while the epidemic raged violently among the whites.

10. Many instances are on record, where foreign residents escaped cholera at the same time that the indigenous population suffered severely by it. This has been observed in India as well as in other countries.

11. Between 1684 and 1690 the native inhabitants of Surat suffered severely by cholera; all the white residents escaped. Similarly, at the same time, the British escaped the epidemic then ranging at Balasore, although their black servants are said in some instances to have died a few hours after leaving their presence. At Belize in 1867 the black population suffered severely, while beyond some diarrhoea the whites had no sign of cholera. At Moradabad in the same year the native Indian troops were subjects of cholera, the British stationed with them enjoying an immunity from it. In the epidemic of 1875 in the Madras Presidency, the disease throughout was almost entirely confined to the native population.

12. It has been stated that the comparative exemption of native troops is accounted for by the circumstance that the men have separate huts and latrines. It is observed in reply, that at Dinapore in 1869 they lived in huts but had no latrines, yet in that year they suffered more than the white troops. Nor can their relative exemption be caused by their supposed less sensitiveness to malaria, for they are said to suffer more from malarial disease than the British stationed in India.

13. The question has yet to be answered, Does cholera in India as a rule prevail among natives and whites at the same time, or does it affect each nationality at a different period of the year?

14. With regard to America it is recorded that in 1849 the disease was introduced by whites along the Arkansas and Missouri rivers, yet that the Indians suffered chiefly by it. During the epidemic of 1873, it is stated that in Alabama the proportion of deaths to population was about one in 107 among the white population, double that number among the colored. In Iowa, on the other hand, most of the cases, and the majority of deaths took place among foreigners, few Americans died, and no Negro was attacked; Danes were particularly liable to the disease. At Jackson, Mass.; the epidemic was nearly quite confined to the Negro population. At Nashville the mortality for the first few days was greater among the white than in the colored population, afterwards the negroes suffered more than the whites. In Gallatin, Ten.; of 120 deaths, four-fifths occurred in negroes, and elsewhere the mortality is described as being five times greater among blacks than in whites.

15. Cholera has prevailed among British troops stationed elsewhere than in the United States, to the almost or complete exclusion of the native population of the vicinity. This happened at Malta in 1848; it has been observed in regard to epidemics in India and in other countries. In this respect cholera follows the rule observed by yellow fever. In very many instances however, cholera affects foreigners and natives simultaneously, although in different degrees.

XLVII. IN RELATION TO NEW AND OLD ARRIVALS.

1. Where cholera prevails, it is considered that those who have been longest in the locality are less liable to attack than the more recently arrived. In some instances both in India and elsewhere this has been the case, but by no means so in all.

2. At Cronstadt in 1829 the crews of all American and English ships arriving during the epidemic were attacked, but the seamen who had passed the summer there were not. In 1832, during the prevalence of cholera in Ceylon, it was stated that new arrivals were most liable to be attacked by the disease, but that the ratio of deaths to attacks was less among them than among those of longer residence. In the Crimea in 1854 it was observed that newly arrived recruits were more liable to attack than soldiers longer resident there. In the American epidemic of 1873, it is recorded that Danish emigrants suffered severely in Iowa, and that of those who died there, all had been less than a year in the country.

3. On the other hand it is recorded that in 1871 the epidemic in the 18th Hussars at Secunderabad chiefly affected the men of longest residence in India. In other instances those of longest residence are the first to be attacked with cholera.

XLVIII. IN RELATION TO CLASSES OF THE NATIVE COMMUNITY.

1. A belief existed in India from 1774 to 1781, that the members of the meat-eating castes were more frequently attacked with cholera than the non-meat eaters. It does not appear that this view has been established by subsequent facts.

2. It is considered that the poorer classes are more liable to attack than those in better conditions. This circumstance, which has many exceptions, when it does happen, perhaps arises from the fact that while the better situated are in a position to attend to personal hygiene, the poorer are not. In the case of the poor and badly fed, the

gastric secretions must be more or less deranged, and this circumstance is said to enhance their liability to attack. When in 1818 cholera first appeared in Bombay, it chiefly prevailed among the poorer classes of natives. At Warsaw in 1830, very few of the better classes were attacked, the disease being almost entirely confined to the poorer part of the population. In America in 1873, although the epidemic was most severe among the poorer classes, the better were not by any means exempt.

3. On occasions, the civil part of the community is attacked to the exclusion of the military and police ; in others the reverse takes place. In 1820, at Tellicherry, the epidemic prevailed chiefly among the beggars and other members of the low classes, sepoy and native policemen being exempt. At Malabar, in the same year, a similar circumstance was observed. In 1843 at Agra the native population suffered severely, the sepoys slightly. In 1848 it prevailed in the bazaars, but only to a slight extent among the sepoys. In 1867, at Dhera Ishmael Khan, the civil population suffered to the exclusion of the sepoys. At Bareilly and Shajehanpore, while the epidemic similarly prevailed among the population, the troops, native and British, suffered only to a very slight extent. At Umballah in the same year, natives belonging to the Sudder Bazaar suffered by the disease, while the sepoys escaped. In 1869, although 150 deaths by the disease took place among the natives around the cantonment of Bangalore, only four happened among those within that cantonment. With regard to this and similar occurrences it is observed that the Madras sepoy lives much in the same manner as his fellow caste man in the bazaar, yet often the sepoy quarters are ravaged by cholera, while hardly a case occurs in the bazaar. In the epidemic of 1872, particular sections of the community suffered severely in some places, while in others, the same sections escaped. It was also observed

that one body of men may suffer at one time, while another body at or near the same place does not become affected until after a certain interval of time.

XLIX. IN RELATION TO CLASSES OF FOREIGN COMMUNITIES.

1. Instances occur in India where the epidemic attacks only one body of British troops in a station, those of other branches of the same service remaining exempt. At Umballah, in 1867, the Infantry suffered severely; the Cavalry and Royal Artillery escaped.

2. Officers, as a rule, suffer less than other classes in a Regiment. In the Indian epidemic of 1869, officers other than medical almost entirely escaped; yet in that of 1867 the first case of the disease at Allahabad occurred in the person of an officer in the Chatham lines.

3. It occasionally happens that the chief severity of an epidemic falls upon the married classes in a Regiment. In the epidemic in the 45th Foot at Neemuch in 1865 this happened. In those of 1869 and 1870 among the troops at Thyet Myo, a similar fact was observed. In the American epidemic of 1873 mortality fell in greater proportion upon the married than the single.

4. The ratio of mortality to cases however among different classes, is not necessarily in accord with the relative liability to attack. In the epidemic at Malta in 1865 the ratio of attacks to strength among officers was 51 per cent; of deaths to attacks 100; of men 2·2 and 72; of soldiers' wives 10 and 72; of their children 3·2 and 73.

5. During the time that English employ  es were engaged in connection with Indian Railways, an endeavour was made to test the relative liability of them and soldiers

to cholera. An average of eleven years in connection with those employées at Allahabad gave 553·8 cases per 1,000 per annum, while in the same period at the same station the ratio among the white troops fluctuated from 41 to 50, and in each of the years 1859, 63 and 69 nearly reached 200.

6. As elsewhere, the poorer classes of foreigners in America suffered most severely. In the epidemic of 1873 it is particularly recorded in regard to Carter county that those usually known as "poor white trash" suffered to the greatest extent. In all countries the lower orders of people as a rule suffer to the greatest extent. This is particularly the case in regard to foreign residents, and no doubt, is in a great measure a result of the imperfect sanitary conditions in which they exist. In Pomerania it was observed that Jews and Gipsies suffered to a greater extent than any other classes; the circumstance being attributed to the greater filthiness of their habits.

L. IN RELATION TO PRISONERS.

1. In France, during the epidemic of 1855, some establishments in the Basses Pyrenees enjoyed complete exemption from cholera; among them the prisons of Prades and Perpignan, a convent, the college, and the educational establishments, with one exception.

2. In Malta, during the epidemic of 1865, the prisoners and prison officials suffered equally with the Military.

3. In 1827 while the epidemic raged severely at Meerut, the inmates of the jail at that station suffered comparatively little by it. During the Indian epidemic of 1867, of 36 prisons in the North-west Provinces, 11 were attacked, and in two only of these did the disease prevail violent-

ly, namely, at Allahabad and Shajehanpore. In the Punjab, out of 29, only eight were attacked ; of 11 in Oude six suffered.

4. In the epidemic of 1869 the inmates of some jails in India suffered, while others had a remarkable immunity. A similar circumstance was observed in 1869, some jails remaining free while the epidemic prevailed all around. It occurred in the jails of Gyah, Patna, and Arrah. In some the disease spread among the prisoners ; in others it was limited to a few cases. In all, it is recorded that communication with the surrounding population was strictly interdicted.

5. When in 1854 cholera prevailed in Oxford, of 95 inmates of prison there, 37 were attacked, besides four officers. It is observed however, with reference to the occurrence, that the water by which the prison was supplied ran through one of the worst diarrhoeal districts of the city, and was otherwise foul.

6. In 1818 the malady was imported into Surat by a body of prisoners. In 1829 cholera was conveyed from Kazan to Persia by a body of prisoners. The disease then broke out in the jail of the latter place. In 1831 and in 1833 it suddenly broke out with great violence among the prisoners in the jail at Shergotty. In 1863 it appeared violently in the jail at Lucknow in a body of prisoners arrived from Seetapore, and rapidly extended through the prison. In 1864 it was introduced into Rangoon and the Andaman Islands by prisoners taken there on board the steamer *Arracan*. In 1873 the disease having been introduced into the prison of Nashville Town, by means of a gang of convicts working on the Memphis and Paducah railroad, of 500 prisoners and attachés almost every prisoner was attacked. The disease in this instance extended from the prison to the town, the sewers being supposed to have been the means of communication.

LI. MAY CHOLERA BECOME ACCLIMATISED OUT OF INDIA.

1. There is said to be reason to believe that cholera has become naturalised and endemic in some countries beyond India, into which it has entered from without. Among such are Europe, the Caucasian Provinces, Turkey in Asia, the north of Africa and both Americas. The International Conference however, without putting aside the possibility of this naturalization becoming permanent, considers such a result to be unlikely.

2. The question has an important bearing on that of international quarantine. If cholera has become thus naturalised, it seems improbable that any commercially active part of the continental area could effectually protect itself by quarantine.

3. There are however, writers who assert that except in India cholera has nowhere become acclimatised; that in all instances outbreaks elsewhere have been traceable to importation from without. Thus it becomes evident that further observation is called for in regard to this important query.

LII. CONSANGUINITY.

I. The circumstance has on several occasions been alluded to in reports, that when cholera has appeared in a family, several members have become subjects of attack, to the exclusion of persons not belonging to the family but residing in the same house. Such occurrences are recorded in connection with the outbreaks at Jaulnah and Arungabad in 1818, and in that of 1820, at Ghooty. In the former year, during the epidemic in the Royal Scots regiment at Arungabad, whole families were in some instances

attacked. Several reports of the epidemic of 1855 in France make mention of similar occurrences, and attribute them to the influence of consanguinity or blood relationship. In the Haute Garonne some families are reported to have been almost destroyed, while strangers employed as attendants escaped.

2. On the other hand, there are in India very few instances in the later outbreaks, where more than one member of a family suffers from the disease in the same epidemic.

3. It is recorded that during the epidemic of 1831-32, in the south of Scotland, cholera attacked three and four members of the same family in several instances. During the American epidemic of 1873, many instances are said to have occurred, calculated to support the belief in the influence of consanguinity. At Caseyville and other places, instances occurred in which the epidemic affected several members of blood relations. In Lexington, Kentucky, similar cases were recorded ; so also at Carthage.

LIII. IMMUNITY OF CERTAIN PERSONS.

1. The great majority of persons are considered to possess a certain measure of resistance against the choleraic influence. Were it otherwise, populations attacked must necessarily be swept away. Similar power of resistance exists in regard to many other epidemic diseases, as plague, small-pox, scarlatina, &c.

2. The degree of exemption of individuals is various. It may be absolute, the persons so endowed remaining free from attack during epidemics, or only suffering more or less from derangement of health, intestinal uneasiness, vertigo, and it may be, diarrhœa. A person exempt in one

epidemic may be attacked and die by the disease in the next. He may resist until towards the end of an epidemic and then succumb to it. This especially in the case of medical men.

3. An expression has been coined to express the degree of liability of individuals to the disease. The extent of that liability and exemption is thus said to be according to that of the receptivity of the person to the poison.

4. In the French epidemic of 1855, of 107 persons taking the sulphurous waters of Enghein, only one was seized with cholera, and *none* with true cholera. It would be important to ascertain how far similar circumstances have been observed elsewhere, and whether exemption attends the use of other mineral waters.

LIV. IMMUNITY OF CERTAIN PLACES.

1. Several countries and islands are said to have hitherto been exempt from visitation by epidemic cholera. Among these are enumerated the Islands of the South Pacific, including Australia and New Zealand; Cape of Good Hope, West Coast of Africa, St. Helena, Ascension, Bermuda, the Islands of the North Atlantic, Iceland, Faroe Island, and the West Coast of South America. Chusan is said to have been exempt till 1840.

2. But there are writers who dispute the complete exemption of some of these. If, they observe, any such exemption really does exist, it is attributable to the inconsiderable traffic carried on with them; or, as in the case of Australia and New Zealand, to the immensity of the ocean barrier by which they are surrounded.

3. Certain portions of a country may remain exempt from the epidemic that has devastated the others. In

France the epidemic of 1832 left thirty provinces exempt, that of 1849 left twenty-nine, that of 1854 left nine, that of 1855 left sixteen. Alpine Switzerland is said to enjoy exemption from the epidemic; so also Aargau, Thurgau, Ticino, Salzburg and Innisbruck. In England, 85 districts are said to be exempt, besides 73 in which diarrhoea existed during epidemic seasons, but did not develop into cholera. In India, Bareilly and some other places in Bengal are said to enjoy similar immunity; in the Madras Presidency it is claimed for Palaveram, Poonamalee, Honore on the coast of Canara, the Salem, Shevaroy and Neilgherry ranges of hills. Mount Aboo is credited with similar exemption.

4. Doubts have been expressed in regard to the absolute degree of exemption of the Neilgherry range. There seems to be no question that the disease has actually been brought both to Wellington and Ootacamund, although it does not appear to have spread in either. In 1854 a disease, described as "resembling cholera," occurred at Coonoor, and 71 per cent of those attacked by it are said to have died.

5. Certain cities are said to enjoy exemption. For example, Lyons has resisted the several epidemics by which France has been visited, although on some occasions a certain number of cases have occurred in it. It is important to observe that a part of the city is built upon low alluvial soil, that it is situated in the confines of two rivers, and that it contains a poor and dense population. Containing as it does a population of 400,000, it entirely escaped the epidemic of 1832; in 1849 it escaped with the exception of a few cases in a barrack; in 1853 it had in all 196 cases; in 1865 only a few. Particular villages may escape while the epidemic rages every where around them. In 1831 Deptford was thus exempt; as were also the agricultural villages around Sunderland.

6. Cholera is not the only epidemic disease from which particular places are exempted. A similar circumstance is recorded in respect to others, notably plague and yellow fever.

7. But places that have been exempt in one epidemic or series of epidemics may suffer from another. **Malta** and **Gozo** are cited in illustration. Of the Departments of **France** affected in 1854, nine had till then escaped; of others, some were then more severely attacked than they had been in either epidemic of 1832 or 1849.

8. With regard to **India**, the city of **Moorshedabad** was exempt from the **Bengal** epidemic of 1867. Five stations were spared by the epidemic of 1867 that had suffered by the epidemic of 1861. In the **Madras** Presidency, **Bellary** and **Kurnool**, exempt in 1867, suffered in 1869. In **Upper India**, **Meean Meer**, which suffered severely in 1856, 1861 and 1862, escaped in 1869; **Simla**, exempt for ten years, suffered severely in 1867 and 1875. **Mooltan**, exempt during twenty-three years, suffered in 1867. **Dugshai**, **Soobathoo** and **Kussowlie**, exempt for several years, suffered in 1872. In **Bundelkhund**, **Nowgong**, exempt till 1875, that year visited by the epidemic.

9. It is accepted as a rule, that when an epidemic attacks a place that has been for a certain time exempt from cholera, the outbreak is more violent than in places more frequently visited by it. Thus the disease is on occasions absent for long intervals from **Bellary**, **Kurnool** and **Cuddapah**, but when it recurs it is peculiarly virulent. The point here raised is one of great importance, and merits careful investigation.

10. Particular establishments in an infected city have continued exempt from the general epidemic. In 1848, **Bartholomew's Hospital**, **London**, with its newly improved drainage and water supply, remained free. In **Oxford** the

city jail escaped, while the county jail suffered in 1832, 1849, and 1854. It is true, that the cause was believed to exist in the water supply, yet the fact is not the less suggestive. During the American epidemic of 1873 it is recorded that in Jackson, Miss: no case of the disease occurred in either the Lunatic, Deaf, or Dumb Asylums; that in New Orleans the Convent of the Sacred Heart and Jefferson College both remained exempt.

11. Some writers have offered an explanation of the immunity of certain places. According to them, the fact of such immunity does not do away with the transmissibility of the disease; it merely indicates that certain local conditions not recognised form an obstacle to the development of the malady.

LV. EXEMPTION (?) OF CERTAIN OCCUPATIONS.

1. According to some writers, persons employed in certain occupations enjoy a greater or less immunity from cholera.

2. At Bellary in 1859 the coolies employed in connection with lime kilns were said to be exempt. There exists a belief in India that this class of labourers are so generally.

3. During the epidemic in France in 1865, it was stated that persons exposed to inhalation of gas from oil escaped, although no such exemption seems to have extended to those employed in the manufacture or ordinary coal gas.

4. Some writers claim for tanners an exemption from cholera. According to others tanners suffer more in proportion than other classes.

5. It has been asserted that workmen in copper mines enjoy exemption from cholera. So in regard to workers in sulphur mines.

6. In India, men employed in gunpowder manufactories are said to be also exempt. This is attributed to the presence of sulphurous acid evolved during a part of the process connected with the manufacture of the gunpowder. Statistics on the subject in regard to Madras, although not fully supporting this view, do not entirely disprove it. If such exemption however, really exists, it is stated to extend to persons in the manufactory whose duties do not bring them in contact with the preparation of sulphur.

7. It is recorded that on the occasion of the epidemic at Lauffen, of the inmates of the prison at that place the joiners suffered most, the agricultural laborers fared best, and next to them rope makers and tailors.

LVI. CASES IN RELATION TO BUILDINGS.

1. During the epidemic in Berlin in 1866, statistics were prepared in regard to 3,539 houses. Of this number 1 death took place in 1784; 2 in 790; 3 in 397; 4 in 215; 5 in 143; 6 in 70; 7 in 42; 8 in 27; 9 in 26; 10 in 17; 11 in 9; 12 in 6; 13 in 7; 14 in 4; 15 in 2, and so on. In the epidemics of 1869 and 73 in the same city, similar statistics were prepared in regard to 4,203 houses. Of them, 1 case occurred in each of 2,277; 2 in 895; 3 in 435; 4 in 231; 5 in 146; 6 in 72; 7 in 44; 8 in 27; 9 in 28; 10 in 17; 12 in 6; 13 in 7; 14 in 5; 15 in 5, and numbers beyond that reaching to 54 in one each.

2. In Moscow, of 101 houses regarding which particulars were noted, one case occurred in each of 33, three in fifteen, four in nine, six in four, seven, and numbers varying up to twenty, in one house each.

3. In Vienna in 1873, statistics were similarly kept. Three cases occurred in each of 114 houses, four in 48, five

in 27, six in 16, seven in 4, eight in 3, nine in 3, ten in 2, thirteen in 2, sixteen and upwards in one each.

4. Among barracks in India, a similar variety in the number of attacks occurring in each has been observed. In some, only one case occurs, while in others, several soldiers become subjects of the disease.

LVII. UPPER AND LOWER STOREYS.

1. In 1829, when cholera prevailed in the 49th Regiment at Berhampore in Bengal, the soldiers and their families who occupied rooms on the ground floor suffered more than those on the upper. In 1869 the first case in the 45th Regiment in Fort St. George occurred among men occupying the ground floor, although the upper rooms were the more crowded. At Thyet Myo in 1873 the ratio of attacks to strength in the same Regiment was 26·5 per 1,000 among those on the upper floor of the hut barracks, and 91 per among those in the ground.

2. Opposite results have been in other instances observed. In 1863, cholera prevailed in the 20th Foot at Benares, and a party of men were temporarily accommodated in what had formerly been the Mint. The building comprised two storeys, was situated within an enclosure, the surrounding wall of considerable height. Cholera attacked those who occupied the upper floor, to the almost if not actual exemption of those on the lower floor. In 1870, the disease was relatively more prevalent among the men of the 1-21st Foot occupying the upper floor in Fort St. George, than among those on the lower.

3. During the epidemic in Scotland in 1831 and 33, it is recorded in regard to Newhaven, that the great number of persons attacked lived in houses of one story with damp

floors, although in other respects their sanitary condition was good. In the epidemic of 1849, on the other hand, upper storeys are reported to have been most unhealthy, the explanation given being no doubt, their faulty construction. In England, on the same occasion, of 373 deaths, 9 took place on the kitchen floor, 60 on the ground floor, 100 on the first floor, 114 on the second floor, and 73 on the third. In Vienna, during the epidemic of 1873, it is recorded that 17 deaths took place in cellars, 667 on ground floor, 867 in second storeys, 639 in third, 398 in fourth, 163 in fifth, and 19 in sixth.

4. From these particulars, the natural inference seems to be, that the differences are not so great as theory would have alone led to suppose. Further observation is therefore desirable. Statistical information on the subject is carefully recorded in India.

LVIII. TRANSMISSIBILITY BY MAN.

1. Transmissibility and epidemicity may co-exist, although their co-existence is not a necessity. This property of cholera first obtained the name of "Contingent Contagion" in Russia during the epidemic of 1829. It is affirmed by the International and other Commissions as being an "undeniable fact, proved by facts which do not admit of any other interpretation." According to the Commission of Constantinople, "it is an established fact that no epidemic of cholera has ever spread from one spot to another where it would not take man to reach it." According to the London College of Physicians, human intercourse has at least a share in the propagation of the disease, and under some circumstances is the most important if not sole means of effecting its diffusion. The College however observe, it by

no means follows that cholera is always propagated in this way; it may spread independently of communication between the sick and the healthy. Questions on the subject having been submitted to medical officers in India, 85 per cent. of their replies were in the affirmative, 11 uncertain, and 2 negative. These results indicate the propriety in times of cholera among the civil population preventing as far as possible communication between them and the military.

2. Transmissibility is believed to be effected by man, whatever be the means of locomotion used. The more rapid and the more multiplied the means, the more is propagation to be dreaded. Regarding the spread of the disease in England in 1849, it is observed that in 119 places, of which 69 were district towns or villages, 15 parishes or districts, 34 public establishments and 1 a private house standing isolated in the country, in 73 instances the disease appeared subsequently to the arrival of infected persons, or to the introduction of other vehicles of infection. *Cæterus paribus*, a great infected multitude or a single infected person may propagate the disease to great distances. This being so stated, the Commission asks, "Why always speak of choleraic source, focus of infection, invading epidemic, when the question is only one of transmissibility?"

3. That persons who are themselves the subjects of cholera are the means of frequently transmitting the disease is a recognised fact, supported by a vast deal of evidence. It is also amply shown that persons in whom the disease has not advanced beyond the stage of diarrhoea, may be the means of propagating epidemic cholera in its fully developed form. In 1865 the men of the 22nd Foot on board H. M's *Orontes*, between Malta and Gibraltar, had only one case of diarrhoea among them, yet were the means of intro-

ducing the epidemic into the latter place. The disease may also be propagated by persons themselves convalescent from an attack.

4. Persons who are themselves in a condition of health are believed, under certain circumstances, to be capable of transmitting cholera, from an infected to an uninfected locality. It is recorded that none of the seamen of the Hamburg vessels, by means of whom the disease was introduced into Sunderland in 1830, were themselves subjects of the disease; in this particular instance the disease was probably conveyed in their effects. In 1853, cholera was introduced into Arbroath by two persons who had visited friends ill with the disease in Dundee. Six of their friends who were in close intercourse with them were attacked, but beyond them it did not spread. In 1866, the disease is believed to have been similarly conveyed from Germany via Hamburg across the German Ocean, the Irish Sea, and for four to six days' sail into the Atlantic before shewing itself as it then did in the ships *England* and *Virginia*. In 1867 the emigrants on board the *Petronella*, by whom the disease was conveyed from New Orleans to Belize, remained healthy during the voyage, but were attacked by it on landing. Medical officers on the spot considered that the introduction this year of cholera into Peshawur was distinctly traceable to returning pilgrims from Hurdwar, no case having occurred for years, and not until their arrival. In 1869 cholera was introduced into Hooshungabad by a man who, himself healthy, had passed through an infected district. He was attacked soon after arrival, but in this instance the disease did not spread. In 1872 it was introduced into Jubbulpore by a woman from Fyzabad. She was herself not attacked until after the death had occurred of several persons in the former place.

5. Cholera may be transmitted to a distance without infecting the intermediate localities. In 1865 some German

families from Prussia, travelling to the village of Borchì in the district of Balta in Russia halted a night at Galatz, where cholera was raging, then passed through Odessa. On arriving at Borchì several of them were attacked and died, and from the place the epidemic spread far and wide.

6. Among many other circumstances which favor the theory of transmissibility of cholera, the following are selected best.

(a.) In 1832, cholera is believed to have been introduced into Holland by means of immigrants from Hull.

(b.) During the epidemics of 1832-33-34 and 35 in North America, in no instance did the disease appear in the interior of the Continent until a sufficient time had elapsed for the conveyance of the infection from the foci established on the sea coast, in the persons of individuals.

(c.) In 1849, the introduction of cholera into Russia was traced to ships arriving from infected ports; into Sebastopol, New York and New Orleans by vessels from Havre, into Nogent-le-Routrou by nurses and nurslings from Paris. On the same occasion, Hamel, a rural commune in France, was free from cholera, when a soldier arrived from Paris where the epidemic was raging. After arrival he became attacked with diarrhoea, and having remained in his father's house four days, was removed to hospital at Amiens. The same day his brother was attacked, then several members of his family in rapid succession.

(d.) In 1850, and again in 1853, to the arrondissement of Montargis, also by nurses and nurslings from Paris.

(e.) In 1851 a man newly arrived in India from the United States was seized with cholera in a hotel, and died. The man who nursed him was sent for a coffin; on his way he stopped to see his wife. She died of cholera two days afterwards: the disease spread, and 280 deaths by it rapidly occurred.

(f.) In 1852 a woman from Sandusky, where cholera prevailed, arrived at Drayton, Ohio. She was suffering from cholera, from which she recovered. Six cases, all fatal, happened immediately afterwards in the house to which she was taken, and the disease spread. In the same year the disease is considered to have been introduced into Kemaon by means of pilgrims from Bhabur.

(g.) In 1853 cholera is considered to have been introduced into Vigo by a ship from the Havanna.

(h.) In 1854 into the east, by means of troop ships from Marseilles. Into the Mauritius by coolies from India arriving by the ship *Sultany*.

(i.) In 1855 into the Cape de Verd Islands by a Sardinian emigrant ship from Savona.

(j.) In 1856 into Madeira by a troop ship from Lisbon. Into the Mauritius by the ships *Hyderee* and *Futteh Moubarick*. They severally arrived at Port Louis on the 5th and 8th of January, having coolies on board. Deaths by cholera had occurred there in both during the voyage. On arrival the coolies were landed at Gabriel Island. A creole on that island having become attacked was landed at Port Louis by the steamer *Victoria*, and the crew of that vessel being permitted to ramble through the town, cholera broke out and sacrificed thousands of victims.

(k.) In 1859 into the Mauritius by the *Topaze* from Calcutta.

(l.) In 1865 into Constantinople by the frigate *Mouk-biri F. Sourour* from Alexandria. There is little doubt that it was this year introduced into Southampton by the steamers *Elora*, *Nyanza*, *Delta* and *Vectis*, and into New York by the *Atlantic*.

(m.) In 1867 into Belise by the ship *Petronella* from New Orleans. In the same year it was stated that in India

the police and railway officials, whose duties took them among the masses of returning pilgrims, suffered more in proportion than the rest of the community.

(n.) In 1869 into Salem, Madras Presidency, by a railway guard who had the previous day attended a woman ill with cholera at Coimbatore.

(o.) In 1872 into Jubbulpore from Fyzabad, and into Lahore by mendicants from an infected locality.

(p.) It is asserted that in the several epidemics in America from 1832 to 1873, cholera was conveyed to Cincinnati by human beings. In the latter year it spread throughout the United States by means of human intercourse, the arrival of a single infected individual being sufficient in the great majority of instances to establish a focus from which the disease radiated. It was thus imported into New Orleans, and thence through the districts along the course of, and adjoining the Mississippi. It is further asserted that when the arrival of an infected individual did not cause the disease, the excreta had in all such cases been disinfected. When outbreaks occur on boardship the disease is said to attack those who have been in contact with it on land, the passengers and not the crews. Exceptions to this are in record.

7. There are individual writers who oppose the doctrine that cholera is transmissible by man. Some of them express an opinion that the disease may be transmitted by the air to great distances, without the aid of human beings or of contaminated objects. Others among them express an opinion that transmissibility is not essential to the spread of an epidemic, the property of the latter being "to propagate itself." Such theories are as yet unsupported by trustworthy facts.

The following are examples of the grounds upon which the theory of non-transmissibility of cholera by human agency is advocated, viz. :

(a.) Attendants upon cholera patients, washermen, and other persons whose duties bring them in close contact with them, as also persons employed in the disposal of the dead, occasionally continue throughout an epidemic exempt from the disease.

(b.) In 1817 there was no greater facility of communication in India than there had been for many years before that date, yet in that year, for the first time after a long interval, did the disease spread.

(c.) At Orenberg in 1829, it was considered that cholera did not at first communicate itself by direct intercourse with the sick; that its infection was not so unequivocal as in most infectious diseases, and that its power did not develop itself in all who were in direct intercourse with the sick, especially at the beginning of the epidemic.

(d.) At Sunderland in 1831, in twenty-one out of the first fifty-four cases, no communication could be traced with the supposed importers of the disease. It is even asserted that none of the ships, by which it was believed the disease was introduced, had a case on board. Kristofsky, situated in the midst of the populous islands of St. Petersburg, communicated freely with them by means of bridges, along all of which traffic was free, yet while cholera raged in St. Petersburg no case occurred in Kristofsky. Opposite to Montreal is the island of St. Helena. When in this year cholera occurred in that city, the military were moved to the island; free intercourse however took place between the barracks of Montreal, yet no case of cholera occurred in St. Helena.

(e.) During the American epidemic of 1833, although Lexington and Versailles were only twelve miles apart, and communication between them uninterrupted, there was no cholera in the latter. In 1834 it was severely ravaged.

(f.) In 1849 it was acknowledged that in Shrewsbury, Oxford, and some other town, also when cholera occurred in public institutions, it was impossible to trace the importation to human intercourse.

(g.) In 1866 the towns along the east coast of England, although in direct communication with infected ports on the continent, were hardly effected.

(h.) In the Indian epidemic of 1867 it is asserted that the introduction of the disease into Murrée could not be traced.

(i.) In that of 1869 it is recorded that cholera spread without communication by human beings being traceable; that its conveyance to Peshawur could not be thus traced.

(k.) In 1870 when the epidemic prevailed in the district of Fyzabad, of villages in close proximity to, and having free communication with each other, some suffered from the disease, some escaped. During the epidemic in Burmah in the same year, no evidence was traced of the persons first attacked at Henzadah, Yendoon or Rangoon having been in contact with the persons, or effects of persons affected; all that can be shown, but it is important is, that the disease travelled along the lines of human intercourse.

(l.) In the epidemic in India of 1871 it has been asserted that no evidence exists of its spread by means of human influence. This statement has however been declared to be rather too absolute. Subsequent inquiries have also thrown light upon the occurrence of the disease this year in the 18th Hussars without, as was supposed at the time, the intervention of transmission by man. On the 24th of May no cholera was known to exist in or near Secunderabad. Investigations have since shown that in the villages on the road to the eastern coast cholera had prevailed for weeks, and that the disease was exceedingly fatal in the village of Sooriapett on the main road, eighty miles from Hyderabad.

On 23rd May three travellers who reached Hyderabad by the eastern road died of cholera. On that date a party of cart drivers arrived at the village of Chilkulgoondum, having been attacked by cholera in the road and lost several of their number. This village is in close proximity to the barracks, hospital, horse lines, and horse-keepers' huts of the 18th Hussars. On the 24th of May one case of diarrhoea in the Regiment. On the night of that day a patient in hospital was attacked with cholera, the epidemic then rapidly spread, attacking eighty-five men out of 385, fifty-six women and 108 children.

(m.) Neither could importation be traced according to some reporters, in regard to the epidemic of 1872 in India. When the British troops at Morar were attacked, there had, it is asserted, been no communication between them and infected places or persons. It is stated that the disease did not advance along the Grand Trunk road to Peshawur. There is, however, reason to believe that it did so, although undetected at the time. On the 6th of July cholera suddenly attacked the boys of St. Peter's College at Agra. There is said in this instance to have been no evidence of the disease having been imported from without. The survivors were sent to their houses, and although several died after reaching them, in no instance did the disease spread. At Morar, Nowgong, Soobathoo, Jullundhur, Ferozepore, Mean Meer, Murree, and Attock, the British troops are said to have been seized without any communication being discovered to have taken place between them and infected persons or places.

(n.) It has been observed that from 1842 to 1872, constant traffic had existed between the plains of India and Kussowlee, yet that during this period cholera had not extended to the latter station. Consequently, traffic alone does not, it is said, necessarily transmit the disease.

(o.) During the epidemic of 1873 in Munich, it is recorded that the inhabitants in flitting from infected localities did not disseminate the disease in their new quarters.

(p.) In Russia, during the last epidemic in that empire, "nowhere was it proved that cholera passed directly from introducing parties to the first persons who were in communication with them on their arrival. There appeared to be some intermediate process required in many instances. Some persons seemed to have no predisposition to the disease, while in others it tended to spread in families." In Astrakan the epidemic appeared severely in districts of the city and in persons who had no acknowledged intercourse with each other.

8. With reference to such statements it is observed that "those who argue that cholera is not contagious or communicable in any way from one to another, use an argument in favor of their position that persons go where there is disease is without taking it. It is observed in reply, because a man may go into battle and return without being shot, is it fair to say there is no danger in bullets?"

9. Adverting to some asserted instances of non-transmissibility of the disease in India, it is observed, "When it is considered that there are forty millions more people in Bengal than were supposed, the untruthfulness of the native, the neglect to note cases of diarrhoea, the fruitless endeavor to connect only fatal cases with each other, the numbers of pilgrims passing in all directions—the fact of its importation not being traced can readily be understood."

10. According to the International Commission, and many individual authorities, there are points in the development of cholera which cannot be explained merely by the transmissibility of the disease. The circumstance of transmissibility loses its importance when in a given place and time all agencies which assist in its transmission

are not met with. Cases without number might be adduced in support of non-transmissibility of cholera, an equal number in support of it. There are however, many other agents than human intercourse at work in the progressive movements of the disease.

11. Among the conclusions arrived at seems to be, that although spread by human intercourse, it originates in places without its being possible to have any previous communication with infected persons. In Paris it is recorded that patients affected with the disease came from different parts of the city; their occupations so different that it was impossible they could have contracted the disease from each other. In 1867, although the introduction of the disease into Hazarah could not be traced, it was believed that it subsequently propagated itself by means of persons. The result of observations seems to be, that cholera is for the most part propagated by human intercourse, that such intercourse does not always diffuse the disease, and that on occasions, the epidemic appears in places where no intercourse can be satisfactorily traced.

LIX. THE QUESTION OF CONTAGION.

1. Prior to 1817 the general impression in India seems to have been that cholera was a *peste particulière*, that it was contagious, and equally to be dreaded as plague. *Contagium*, the actual principle upon which the assumed contagiousness of cholera depends, is defined as being a specific matter arising within the body and distinguished from *miasm*, by the circumstance that the latter is an infectious matter arising outside the body.

2. In England and elsewhere the disease had, during the sixteenth and seventeenth centuries, been looked upon on the contrary as non-contagious.

3. It is considered that in India, heat, filth, carelessness and overcrowding are capable of making a non-contagious disease at least infectious, that while it is impossible to resist the evidence that cholera is at certain times contagious, the circumstance is acknowledged that it is persistent in a very slight degree in the better houses and in the hospitals of Bengal. The question of contagion is obviously allied and very closely to that of Transmissibility.

4. At Astrachan a comparison was instituted between the contagiousness of plague and of cholera. It was observed that five out of ten exposed to the former might take the disease, but no more than two out of ten in the case of cholera, except under particularly favorable circumstances.

5. A difference has also been drawn between the contagion of cholera and that of yellow fever. The contagion of cholera when the disease has appeared in a ship, is said to disappear rapidly, not to return; that of yellow fever to be liable to light up again after an interval of exemption. It is doubtful, however, how far the distinction is real. In 1834, three gentlemen started from Quebec to Lake Beaufort, twelve miles off to shoot. On the way they rested at the house of a farmer, were shown into a room, drank some brandy, then started on their journey. All three took cholera, and two of them died within two days. The wife of the farmer had died of cholera in the room in which they had been accommodated, and it had been kept shut from that time until then. Many similar instances are related.

6. As with all epidemic diseases, cholera appears to have periods when it spreads widely, and other periods during which it remains dormant. It would also seem that the capability of spreading by contagion independent of epidemicity varies according to circumstances.

7. According to the Constantinople Commission, the cholera poison is not received through the skin, neither is actual contact necessary for its transmission. Numerous instances are recorded of the disease extending where human intercourse was impossible.

8. In twenty-five years, neither washermen, dresser, nor any other servant in the Civil Hospital, Calcutta, was attacked with cholera, and during twenty-two years no more than two cases of the disease occurred there in which any contagion could be suspected.

9. Contagion is considered to be alone incapable of accounting for all the phenomena of the spread of cholera. According to the International Commission, although communicable by the touch, it is less so than some other epidemic diseases, notably small-pox. The fact is acknowledged that it seldom spreads from bed to bed in a hospital, nevertheless, that under certain circumstances it may be thus communicated.

LX. INOCULATION WITH CHOLERA.

1. Physicians have inoculated themselves with the blood of cholera patients and tasted their discharges, and have suffered no inconvenience from their experiments.

2. On the other hand, a case is recorded in the Reports of French epidemics, in which death in the person of a medical man followed inoculation by cholera discharges. It has been experimentally proved that mammalia inoculated with matters of cholera have become affected with the disease.

LXI. RELATIVE LIABILITY OF ATTENDANTS TO ATTACK.

1. (a.) At Jaulnah, in 1818, sepoy attendants on cholera sick were attacked in such numbers that others had to be forced to perform the duty.

(b.) In 1820, at Ghooty, great numbers of attendants on cholera sick were attacked.

(c.) In 1829, at Astrachan, attendants at first escaped. Afterwards there died three medical men, some hospital attendants, and a majority of female nurses. In one hospital six attendants were attacked.

(d.) In 1832 the cases of cholera among attendants in Edinburgh were in the proportion of one in five against one in 1,200 of the general population.

(e.) In the epidemic of 1848 in England many deaths took place among nurses, medical men, and clergy in attendance on the sick.

(f.) In 1849, at the Salpêtrière in Paris, the director, two internes, and several infirmiers succumbed, while a number of medical men and employées were attacked. In Edinburgh, during the same year, one-fourth of the nurses in the cholera hospital were attacked, while in the general hospital only a few paces distant, and into which no cholera patients were admitted, no attendants were attacked.

(g.) In 1854, a man and his wife in Oxford having died by cholera; out of thirteen neighbours who had visited and attended them, eleven were attacked; of four who carried the bodies of the diseased, two were attacked. In the Crimea among the men of the Ambulance Corps the proportion of admissions and deaths far exceeded that of any division of the army.

(h.) In 1855, during the epidemic in France, several reports make mention of the increased liability of attendants to attack as compared to other persons.

(i.) In 1861, at Meean Meer, of 1,002 men, 869 were employed as hospital orderlies. Of these, 428 were seized with cholera. In another regiment at the same station, of 203 cases of cholera, 137 occurred among hospital orderlies.

(j.) In the epidemic of 1865, a similar circumstance is related. It is recorded that the number of medical men and nurses attacked was remarkable. In Madras, fifteen attendants on cholera sick were attacked by the disease. At Ancona eleven medical men succumbed to it.

(k.) In 1866, three medical men died by cholera in the Paris epidemic, and thirty *sisters* at Amiens, of those attending in the cholera hospital. At Halle, of sixty-one physicians, eight were attacked and three died; also large numbers of nurses. At Moscow, three clergymen of those who had attended dying prisoners succumbed, the medical staff and nurses in the hospitals were heavily attacked. In America, all the attendants at one post hospital were attacked.

(l.) In 1867, reports of the epidemic at Shajehanpore state that an unusual number of attendants were attacked, and that the circumstance was attributable to fatigue and continued loss of rest.

(m.) In 1869, in India, three medical officers died by the disease.

(n.) In 1873 in a private establishment in Berlin, used as a cholera hospital, forty-six out of eighty-one attendants were attacked. In America, attendants on the sick of that disease, were very often attacked.

(o.) In India, the increased liability of attendants to attack is assumed as a fact for the purpose of instituting

orders on the subject. Natives are directed to be employed as much as possible instead of white men, as attendants upon British soldiers sick by the disease during epidemics.

2. On the other hand, the principle seems to be accepted by many writers that attendants are not liable to attack in the sense that they are to small-pox, scarlet fever, &c., from patients suffering from those diseases, at the same time it being allowed that cholera has the property of transmissibility. It is recorded in support, that during the epidemic in Calcutta in 1827, none of the attendants, black or white in the general hospital there suffered, although the wards were filled with cholera patients. In Russia in 1829, of 42 attendants in the Naval Hospital at Cronstadt all escaped; in the Military Hospital ten men employed in carrying the sick all escaped. In the epidemic of 1831 in Scotland, medical men and nurses were generally exempt. In Paris in 1832, of upwards of 2,000 persons employed in cholera hospitals, only 164 were attacked with cholera; of 58 at St. Petersburg only one succumbed; of 123 in one hospital at Moscow only two, and of 253 in another hospital in the city only four. At Oxford in 1854 one medical man died, one was in danger, and several had choleraic diarrhoea. The nurses were tolerably exempt, only three being attacked.

3. During the epidemic of 1861 in India, although at Meean Meer the mortality among the soldier orderlies was very great, the medical officers and native attendants entirely escaped. At Peshawur in 1869, a surgeon and one orderly out of nineteen were attacked. At Morar and nearly all other stations throughout India, however, the attendants were exempt. In the jail at Gorruckpore six attendants were attacked, but in this instance it is observed that prisoners in the same jail were attacked who could not

be traced as having had communication with the infected. In the Indian epidemic of 1872, only one medical officer is reported to have been attacked; of forty native attendants at Fyzabad in that year none were attacked. Of those employed severally at Lucknow, Dugshai, Jullundhur and several other places all escaped. At Allahabad in the same year, of thirty English attendants five were attacked, they having been at their work from three to six days. Yet those who escaped were at theirs twenty-six to twenty-eight days. Throughout the several epidemics in Burmah the attendants are stated to have continued exempt, even when it was impossible to maintain perfect cleanliness among them.

4. In 1873 it is recorded that in Germany, physicians and attendants were seldom attacked. The former soon learnt, however, that they preferred being in more ventilated rooms, to crowded wards of hospitals. At Lauffen, attendants were conspicuous for their immunity; of twenty prisoners who attended on their fellow prisoners only three were attacked, of whom two had only diarrhoea; of thirteen regular and official attendants only one, and he with slight diarrhoea. In St. Petersburg, in some hospitals, none were attacked, in others many; probably, it was assumed, in proportion to the state of cleanliness and ventilation of the establishments. In America, it was remarked that while in the majority of instances the attendants of cholera sick escaped the disease, yet a sufficient number of instances are recorded to demonstrate the danger of attack that exists.

5. Is therefore the liability to attack or exemption, of attendants actual or apparent only? Is either constant? If real, what are the probable causes? What degree of correctness attaches to the explanation given by the French, namely, that whatever degree of exemption attendants do possess, is explained by "moral power, and consequent resistance of those to their sentiment of duty, and to their habit of struggling with disease?" The explanation may

have some force in the west, but in India, only in relation to British attendants. Natives cannot with truth be accused of any such sentiment.

6. It is asserted with apparent reason, that medical men who resist the early periods of an epidemic not unfrequently succumb in its decline. Are they then, rendered prone to attack by the combined effects of exhaustion, anxiety and depression? They are assuredly subjected to those influences, and beyond doubt suffer from them. Is it the case that attendants are more liable to attack by the disease in the relatively less open hospitals of the west than in the capacious and airy buildings of India? It would seem as if they were so.

LXII. VEHICLES AND RECEPTACLES OF CHOLERA POISON.

1. The vehicles or agents by which the cholera principle penetrates the system, are considered to be the atmosphere, water, and it is believed by some authors, certain ingesta.

2. The poison is considered to be most frequently conveyed by soiled hands of attendants, by body linen and other articles in use, by water, tainted by discharges. It is also considered that the poison may spread itself in the air with the products of evaporation, and dry, with dust containing it. Emanations from cesspools, &c., may convey cholera poison by means of inspired air to the lungs, or with the saliva to the digestive organs.

3. It may be received into the system through the respiratory passages, and by the digestive organs; in the one case being inhaled, in the other swallowed. According to the opinion expressed by the International Commission it is not receivable through the skin. There are those who

observe that the profuse cold perspiration of a cholera patient, from its peculiar and characteristic odor is an evidence of the elimination of the disease by the skin.

4. The poison is considered to be capable of being regenerated in the intestinal canal, and propagated by alvine evacuations; also it is believed by some writers that its origin takes place in that canal, perhaps to the exclusion of all other parts of the organism. Cholera is not transmitted from man to man by contact, but by an organic infecting matter passed with the evacuations of those affected, which must gain access to the intestinal canal of another person before he can be attacked with cholera. In this, it is added, lies the whole secret of an effectual preventive treatment.

5. With regard to individual outbreaks of cholera, it is at times impossible to determine the precise vehicle by which the causative influence has been received into the system.

LXIII. AIR AS A VEHICLE.

1. The principle has been accepted by International and other Commissions of inquiry, that the causative influence of cholera may rise into the air with the products of evaporation from the body of a cholera patient; also that it may become diffused in the air with dust.

2. That such is the case, is supported by the circumstance recorded in regard to epidemics in France, India and elsewhere. In both countries, an odor of infection and cadaveric putrefaction has, it is said in occasional instances, been perceived at small distances from a subject of the disease, producing in the recipients effects varying in intensity from temporary malaise to confirmed cholera.

3. That air is one of the chief if not the sole vehicle of the cholera principle is by many writers accepted. The distance within which this operation takes place, however, and that to which the influence can be thus conveyed irrespective of winds, are both considered to be very limited. The Constantinople Commission admit such possibility to a distance of one or more miles ; other bodies consider that the sphere is limited within 110 yards. Beyond these distances, when the epidemic passes from an infected to a healthy locality, personal communication, it is observed, may in all cases be found to have taken place.

4. Confined air, or that vitiated by vegetable or animal decomposition, renders the system adapted to contract cholera, and the disease more fatal in its attacks. This appears to be generally accepted as a principle.

5. The beneficial effects of pure air both as a preservative against, and an auxiliary to treatment during attacks are equally accepted.

6. How then is the question to be answered, Can cholera be received by one set of persons without direct communication with the affected, merely by atmospheric or other transmission ? The bulk of evidence collected in these notes points to such a possibility within certain limits.

LXIV. IN RELATION TO ATMOSPHERIC CONDITIONS.

1. (a.) In 1820, the Medical Board in Calcutta considered that a humid atmosphere was favourable to the occurrence of cholera, also alternations of heat and cold combined with rain. It is observed that in February 1818 and April 1819, the two most marked periods of its aggravation, the days were sultry, the nights cold, with heavy storms from the north and east.

(b.) The several epidemics in India from 1832 to 1848 occurred for the most part with a comparatively stagnant state of the atmosphere, with general high barometric pressure, defective electricity, and with the prevalence of a fog or mist. In 1834 the disease appeared at Muttra when a sudden cessation of rain was succeeded by hot, dry, sultry enervating weather. At Meerut, in 1838, prior to its outbreak, the atmosphere had been hot and close, the rains having produced little diminution of the temperature. In 1845, at Umballah, after the heavy rains had suddenly ceased, the sun shone out, and cholera appeared. At Madras in the same year the occurrence of the epidemic was attended by a hot land wind during the day with heavy rainfall in the evening.

(c.) In 1846 the outbreak at Kurrachee was accompanied by a moist, stagnant state of the atmosphere. It deserves to be noticed that the rainfall at this station, as in Scinde generally, is particularly small, and that when two years afterwards, namely, in 1848, cholera prevailed in the Upper Provinces of Bengal, there was a great deficiency of rain.

(d.) When in 1853 cholera prevailed in England, the state of the atmosphere was one of unusual dryness.

(e.) In 1854 in India, the epidemic was attended by a state of low pressure and temperature for the season of the year, with rain and constant movement of the atmosphere. At Oxford on the same occasion the weather was unusually fine, the air dry, the sky clear, winds were sufficiently strong to blow down the tents erected for hospital purposes. In England generally, the outbreak seemed to occur in the absence of those atmospheric changes which usually purify the air; to be accompanied with high barometric pressure, excessive night temperature, hazy air, absence of wind, ozone and electricity. These conditions are said to have characterised all the seasons in which the disease has

prevailed in London. At Scutari, the disease was coincident with a change from dry weather to a humid state of the atmosphere, with high barometric pressure. In 1856 the occurrence of heavy rains at Agra, Ferozepore, Lahore and Umritsur was attended by the prevalence of cholera at those places. A similar circumstance was also observed in 1861. In 1866 cholera in the Rajpootana States broke out with, and continued during the prevalence of the rains.

(f.) Prior to the outbreak in India of 1867, the wet and dry seasons were at first deferred, afterwards interrupted by dust storms, followed by rain, and general state of electric tension prevailing. The rain-fall was excessive, and the disappearance of the epidemic considered in a great degree with the establishment of the south-west monsoon.

(g.) In 1872, while the epidemic prevailed in Lower Bengal, the rains of the season were light. In the North-west Provinces no peculiarity in the state of the weather was observed. In the Punjab the rains were heavier than usual. At Secunderabad the maximum shade temperature was 109° F. ; no rain had fallen for several days, and then only 0·14 inch.

(h.) When in 1873, the epidemic was travelling up the valley of the Irawaddy, no rain had fallen for a considerable time, nor could any connection be traced between the amount of rain-fall in Burmah and the prevalence of cholera. In America, during the epidemic of the same year, it is recorded that in Cincinnati there was no peculiar atmospheric condition present beyond what was observed in ordinary years. At Carthage a heavy day's rain followed by sunshine preceded each instalment, the former without the latter checked it.

2. The conclusion arrived at in relation to the four epidemics of the disease in France is, that cholera seems unaffected by the state of ozone, electricity or barometric pressure

of the atmosphere ; that although certain variations of these have been observed in partial epidemics, such is the rule. It prevails in the opposite states of heat and cold, humidity and dryness, high and low barometric pressure. It is no less fatal in the moist climate of Burmah than in the parched districts of Upper India.

3. Although in 1865 the circumstances of Gozo were precisely similar to those of Malta, and the island exposed to similar atmospheric variations, several weeks elapsed between the occurrence of cholera at Malta and its extension to Gozo. No connection was found to exist between the outbreak of the disease at Hurdwar in 1867 and the state of the atmosphere. In 1869-70, cholera in Burmah prevailed during the period of greatest atmospheric dryness. In the epidemic of 1872 no rain had fallen at Lucknow for ten days prior to the outbreak. The prevalence of easterly and south-easterly winds was noted at some places. At times a close oppressive feeling was observed. At Agra a fierce hot wind blew from the south-west. At Fyzabad, Deyrah, Phillour and Murree the existence of a heavy mist or fog was observed. Flights of locusts passed over many places.

4. The general results have been formulated as follows, viz. :—

(a.) A high temperature favors the spread of the disease ; when cholera prevails with a low temperature, its cause is probably in connection with the water. It is most active when the thermometer stands at from 70° F. to 94° F. Under ordinary circumstances a temperature below 40° F. is sufficient to stay the disease as an epidemic.

(b.) Atmospheric pressure has no effect upon it.

(c.) Moisture with heat is probably an accessory.

(d.) Dryness seems to check cholera. In districts absolutely free from moisture the disease can only be generated to a limited extent.

(e.) Rain sometimes augments, sometimes checks it. A heavy fall of rain is a great purifier of the atmosphere and also of the surface soil.

(f.) Cholera is generally most violent in a stagnant condition of the atmosphere.

(g.) The state of atmospheric electricity is not known to have any effect upon the disease.

(h.) Neither has the presence or absence of ozone any known influence in regard to it.

LXV. ORGANISMS IN THE ATMOSPHERE.

1. The result of microscopic examination is that no specific cholera germ is found in the air. No connection can be traced between the numbers of bacteriæ, spores, &c. in the air, and the occurrence of diarrhoea or cholera ; or between the presence or abundance of any special forms of cells and the prevalence of either disease.

LXVI. IN RELATION TO PREVAILING WINDS.

1. Cholera is by some writers believed to prevail at particular places during the continuance of certain winds. Thus, at Pondicherry in 1769 it occurred during the prevalence of north wind in December, continued while it prevailed through December, January and February and ceased with its cessation. At Hurdwar in 1783 an easterly wind springing up after a hot night, cholera broke out with great violence. At Guntoor the epidemic of 1818 was considered to be most violent during the prevalence of easterly winds.

2. Some Indian writers affirm that the epidemic disease is conveyed by prevailing, and checked by opposing, winds. Thus it is asserted, that the epidemic of 1869 was checked

in its southward course by the south-west monsoon. Experience gives many examples of the disease in India, where the epidemic has followed the course of the prevailing wind, and thus seemed to travel by the shortest route instead of along the line of human intercourse ; also, that the prevalence of the disease appears to be effected by winds coming across foul places, and by shifts of wind. For purposes of sanitation, it is a matter of prudence to act as if winds did convey the epidemic. Marches in times of prevalence of cholera are recommended to be made at right angles to, not parallel to the prevailing wind.

3. The result of observation in Madras is stated to be that cholera does not occur there during the prevalence of wind directly from the sea, but that a land wind, either from north or south-west, not unfrequently coincides with a development of the disease.

4. In the epidemic in France, it is recorded that while the winds in one part of the country seemed to have no influence upon the occurrence or disappearance of cholera, they seemed in others to have real influence upon its propagation to short distances. At St. Loup a street was alone affected under the wind from a cemetery where the body of a person dead by cholera had been interred ; at Villerezel a similar occurrence is recorded as having taken place.

5. According to the opinions of International Commissions, the movement of cholera is independent of the strength or direction of the wind ; no relation is shown to exist between the movement of the disease and the monsoon winds. They observe that although in many instances it seems to travel with the wind, it does not do so in all ; that in many others, it travels directly against the prevailing current, and that it is neither accelerated nor retarded by winds ; finally, that no fixed relation exists between the quarter from which the wind prevails and the progress or intensity of the disease.

6. French reporters observe that the monsoon winds travel at the rate of 200 to 300 miles in the twenty-four hours; but there is no instance of cholera advancing at any thing like that rate.

7. In 1818 cholera travelled between Badarull and Dharwar against a strong wind from the south-west; from Nagpore to Arcot against the south-west monsoon, nor did a change in the monsoon hurry its advance. It traversed the peninsula of India in that year from east to west, and for hundreds of miles from north to south during the south-west monsoon, unaffected by change in the monsoon. It passed from the Nerbudda to Bombay against the monsoon at the same rate and time that it was progressing from Madras to Cape Comorin with that wind. In 1829 cholera occurred at Krasnvijar to the east of Astrachan; the wind blew all the time from north-east and south-east, while only westerly winds could convey it from the latter place. In 1837, it is recorded that neither was its prevalence at Madras decreased by cool winds from the north, nor increased by warm winds from the south. The course of the Indian epidemic of 1856 is said to have been unaffected by the wind. In July 1860 at Ganjam the epidemic advanced against the south-west monsoon. In January 1865 the epidemic on the east coast of Africa extended northward against the prevailing monsoon. In that year it was transported from Alexandria by steam navigation to the most opposite quarters, regardless of winds and of all other atmospheric conditions. In the same year it advanced southward from Bengal against the south-west monsoon. In 1869 the epidemic in Burmah travelled southward against the prevailing winds. At Gooty and at Ganjam in the same year its progress was against the prevailing monsoon. In 1870 a similar occurrence happened in Burmah. The epidemic of 1869-70 traversed the Madras Presidency in opposition to the prevailing wind, although during April, May,

and June. The velocity of the south-west monsoon equalled 250 miles in twenty-four hours. In 1872 the progress of the epidemic was in a direction against the wind. In 1873, during the months of April and May, while a dry wind prevailed, the 45th Regiment at Thyet Myo suffered severely from the epidemic, at the same time that the occupants of the native town and jail situated to windward, and the Royal Artillery and Syces to leeward all escaped. The natural question is moreover asked, If cholera spreads from evacuations thrown upon the ground, and they being disseminated by the wind, how do we account for exempted places in the near vicinity and to leeward of those where this occurs?

LXVII. IN RELATION TO STORMS.

1. An impression exists that the occurrence of a thunder storm in "epidemic seasons" heralds the disappearance of cholera.

(a.) At Madras in 1818 the epidemic suddenly declined after such an occurrence.

(b.) At Bathurst in the Gambia a similar occurrence was recorded.

(c.) In 1869 the epidemic which then raged in the jail at Jounpore suddenly disappeared after the occurrence of a storm there on the 15th of August.

(d.) In 1871 a severe dust storm heralded the disappearance of cholera from among the 18th Hussars at Secunderabad.

2. On the other hand there have been instances in which the occurrence of epidemic cholera took place immediately after a thunder storm and heavy rain, viz. :

(a.) In 1790, a detachment of troops en route from Bengal to Madras via Ganjam were near the Chilka lake attacked by cholera in the month of March, the outbreak being heralded by a storm of thunder and rain.

(b.) At Meerut in 1845 the epidemic burst out violently in the 10th Foot after such an occurrence.

(c.) In 1846, in the 86th Regiment at Kurrachee, after such a storm.

(d.) In 1861, again at Meerut as in 1865.

(e.) In 1867 at Hurdwar, Meerut and Peshawur, the occurrence of the disease was preceded by storms of winds; at the first two places attended by rain, at the last by dust. At Morar the closeness of the atmosphere indicated the existence of conditions such as usually precede a storm.

3. It is recorded that in the case of the 35th Regiment at Fyzabad in 1867, after a storm of dust had passed over that station, the inmates of one of the hospital wards became sensible of an odor so offensive that all the windward doors were closed to exclude it, and that within an hour afterwards cholera manifested itself.

4. In 1872 several instances are related in reference to the epidemic in India, in which no storm or other atmospheric perturbation heralded an outbreak of cholera. Similar observations have also been made in regard to cholera epidemics of other years.

LXVIII. IN RELATION TO SEASON.

1. From the history of cholera in modern times the following particulars are gathered, viz. :

(a.) In 1543 a severe epidemic of the disease occurred at Goa in spring.

(b.) From 1684 it prevailed in Surat for some years during the rains and after them. In this interval it is recorded that although the epidemic began in July and August, it broke out afresh in the cold weather.

(c.) From 1774 to 1781 it prevailed on the Pondicherry coast during December, January and February, except in 1775, on which occasion it prevailed in July and August.

(d.) In 1781 at Ganjam it occurred in March, extending to Calcutta in April.

(e.) In 1790 a detachment of troops en route from Bengal to Madras were, as already observed, attacked by the epidemic in the month of March when near the Chilka lake, and the disease continued among them through April.

(f.) From 1791 to 1794 cholera is said to have recurred at Chittagong every hot season.

(g.) In 1796 it was described at Bombay as a disease of the dry months. On the coast of Malabar in that year it prevailed from October to December; in that of Coromandel in April and May.

(h.) The year 1817 is by some writers considered to have been the beginning of a new era of cholera. On the 30th March in that year a soldier of the 59th Regiment was attacked by it in Fort William, Calcutta. Rain fell in May, June and July, during which months the disease scarcely prevailed; it increased slightly in August, again languished, to break out with greater violence in February 1818, from which date it has continued to recur in Calcutta; at the same period. In May 1817 it occurred at Kishnaghur, in June; at Mymensing, Patna and Dacca in; July at Calcutta and Jessore in August; Ghazepore and Chittagong in the same month, that is, during the rainy season.

(i.) In 1818 the epidemic prevailed at Bombay in August.

(j.) In 1819-20 in the Mauritius from November till April.

(k.) In 1822, on the south-western shores of the Caspian sea; it languished during winter, broke out afresh the following April, and continued till September 1823.

(l.) In 1829 it raged in the northern provinces of Persia. In August it appeared at Orenberg, died out in winter, reappeared in the spring of 1830 and spread.

(m.) In 1830-31 the epidemic at Moscow was not arrested by winter. It is observed however that perhaps the disease was influenced by the camp movements of troops then taking place. The disease spread in the armies of Poland during this winter.

(n.) In 1831-32 the epidemic in England continued to prevail through the winter season. Being introduced into Charlestown, Carolina, by the brig *Amelia* in November, the disease did not extend.

(o.) In 1833 it reached Cuba in February; it prevailed there during April, May, June and July, and thence spread in all directions.

(p.) In 1837 it appeared in Malta in July and continued till October.

(q.) In 1846 it entered Russia from Persia in October, continued to spread till December, then ceased, to break out violently the following April, and spread extensively.

(r.) In 1847-48 isolated cases continued to occur in Moscow throughout the winter, the epidemic breaking out violently in the succeeding summer.

(s.) In 1848 the epidemic prevailed at New York in May, Paris in June, Canada in July and September, New Orleans in December and in January 1849.

(*t.*) In 1849 it occurred at Bombay in August as it had done in 1818.

(*u.*) In 1853 it prevailed slightly through the winter, to recur violently the following year, and then continued persistent.

(*v.*) In 1854 it prevailed at the Mauritius in May and June.

(*w.*) In 1855 lasted in France throughout the winter, the greatest violence of the disease having taken place in June, July, August and September. In Russia also during those months, the greatest mortality in both countries taking place in August. It is moreover observed that in the four great epidemics that have visited London, the greatest mortality has taken place in August, September and October.

(*x.*) In 1859 the disease prevailed at the Mauritius in October and November; along the Cape frontier from March till June, and at Cape Town from December till March.

(*y.*) In 1861 the outbreak at Meean Meer occurred on 2nd August.

(*z.*) In 1863 cholera prevailed in the Central Provinces of India during October and November, at Bombay in July, and at Madras during the three first months of the year.

(*a*¹.) In 1869 the epidemic at Kurnool disappeared as the hot weather advanced, to burst out afresh with the monsoon rains of June and July. At Adoni it raged in May and June, and is said to have ceased with the setting in of the rains.

(*b*¹.) In 1869-70 the British Regiment then stationed at Thyet Myo suffered by the epidemic in the hot weather of each year, the men of the Royal Artillery in the rainy season, the Native Infantry and the inhabitants of the bazaars, Burmese and Indians escaping on both occasions.

(c¹.) In 1871 cholera occurred at Secunderabad on 25th May. In India generally, the epidemic of that year is said to have shown a marked decrease in the low lying tracts, coincident with their submergence by the rains.

(d¹.) In 1872 the epidemic occurred at Meean Meer on 31st of July, in Bokhara and at Meshed in August.

(e¹.) In 1873 at Thyet Myo among the British Infantry in the hot weather, in the Royal Artillery during the rains.

2. The result of observation in India appears to have led to the conclusion that no widespread epidemic has occurred in that country except during, or immediately after rain; that there and in Burmah the rainy season is its most favorite period, although epidemics have made their appearance in the dry season. Prior to 1817 it was remarked that on the Malabar Coast the last months of the year were its favorite period; in Ganjam and Calcutta the hot season; that from Surat to Bombay and Goa it prevailed earlier than it did farther down the coast. To all these instances there are exceptions.

3. As a rule the disease is believed to assume an epidemic form in Bengal between April and August; in the North-western Provinces in July and August, ending at the beginning of winter; at Bombay from April to September; in the Madras Presidency during the hottest period of the year. It is considered that generally throughout India, the hot season is the period of its greatest prevalence.

4. In the Madras Presidency, as in Ceylon, there seem really to be two cholera seasons, namely, the hot, and again the cold; the period of minimum prevalence there being that of its maximum at Calcutta. The number of outbreaks in the Madras Presidency are double in the rainy part of the hot season to what they are in the dry, and said to be greatest of all when the seasons are irregular, dry weather and rains alternating with each other. It is also observed with reference to the Madras Presidency that the

track of country between 19° and 14° N. is most liable to epidemics of cholera during the south-west monsoon ; below the 13th degree, during the north-east monsoon, while between 14° and 13° N. it is liable to prevail during either monsoon ; or both.

5. It is considered that the British troops in India are more liable to attack by cholera in the first than in the second half of the year in the proportion of 16 to 10 per 1,000 ; that the ratio of deaths to strength also varies in these two periods, from 1 in 4·4 in the former to 1 in 2·80 in the latter. From these figures it appears that the period of greatest prevalence of the disease is that of the smallest mortality by it.

6. The general result seems to be that cholera is not excluded by any climate or temperature ; although in some instances arrested by cold, it has in others, as in France and Russia, prevailed in the severity of winter with equal intensity as in summer ; that upon the whole, however, the more rapid course of the disease is in proportion to the elevation of temperature, the slower to its depression.

LXIX. WATER IN RELATION TO CHOLERA.

1. The water of military stations in India is considered to undergo deterioration in proportion to the length of time the station is occupied. This deterioration takes place by saturation of the soil as in the case of wells and reservoirs, also by direct introduction of organic matters as in the case of streams and rivers.

2. In that country the belief exists, that the prevalence of cholera both in the dry season and in the rainy has a direct reference to the agency of water in its causation. In the latter part of the hot season the supply is scanty,

and hence considered to contain a large proportion of organic matter ; in the rains, the wells and tanks are polluted by drainage.

3. International Commissions doubt if boiling or filtration, or both combined, are sufficient to counteract contamination with choleraic poison. This point has an important bearing in reference to so called *analysis* of waters in India and elsewhere. Can such *analysis* determine the presence or absence of the causative influence of cholera in a given water? The Commissions alluded to suggest that in addition to filtration, permanganate of potass should be added to water made use of in times of cholera. The sources of water supply should, it is said, be at a distance from cantonments, the conduits being closed channels.

4. The question has been asked, Will filtration alone remove from water the poison of cholera? A similar query has been proposed in regard to those of some other diseases, particularly ague, typhoid fever and dysentery. So far, the replies given have been negative.

5. As a general principle it is accepted that deficient water supply, so long as the water is of good quality, is less injurious than contaminated water, although the supply be abundant. It is observed by some writers that water impregnated with organic matters, even when it does not actually induce cholera, becomes one of the predisposing causes of the disease. This applies to rivers that flow past large cities, to wells that receive the filtration of soils impregnated with matters from sinks and cesspools. It is generally admitted that water thus impregnated becomes a ready vehicle of the morbid principle and serves to propagate the disease. There is every reason to believe that water may become contaminated by effluvia from cholera dejecta, and thus be the means of producing the disease. It is believed that the occurrence of the epidemic of 1866 in the City of London Union Workhouse was due to this cause.

6. In the history of cholera, numerous instances are adduced illustrative of the connection between water and the propagation of the disease.

(a.) From 1620 to 1629 a belief was expressed in records, that among the causes of cholera, one was drinking water in excess. At that period little comparative care was bestowed upon the purity of the supply.

(b.) In 1832, at Exeter, water was raised from a part of the river Exe, that was contaminated by cloacæ; 1,000 attacks of cholera, 347 fatal, occurred there during the epidemic of that year. Subsequently, the water supply was brought from a distance of two leagues; in 1849 only 44 cases occurred; in 1854 scarcely any. At Hull, although the water supply was defective in quantity, it was good in quality, there, 300 deaths occurred during the epidemic. Shortly afterwards, water was brought from the river exposed to the tide, and contaminated by cholera excreta, and in the epidemic of 1849 there occurred in the town 1,834 fatal cases of the disease.

(c.) During the epidemic of 1849 in Scotland, reports of the disease contain some striking coincidences between the abatement of the disease and the introduction of a pure water supply.

(d.) In each of the epidemics in America of 1849, 52, 54 and 73, instances are related of cholera being propagated by means of drinking water.

(e.) Great importance is attached to the experience of the epidemic in England in 1853-54. The difference is often quoted that was then observed in the rates of mortality among the population, whose water supply was obtained from the Lambeth Water Company, and in that supplied by the Southwark, the difference, according to population, being 2,500 deaths among the latter more than in the former.

The Lambeth water was obtained from the Thames at Teddington lock ; that of the Southwark Company from the river at Vauxhall bridge. The former was pure, and of those who made use of it the rate of mortality was 37 per 10,000 : the latter was impregnated with the sewage of the metropolis, and of those who made use of it the death rate was 130 per 10,000.

(f.) In the same year the case of " the Broad Street Pump" occurred. A lady who had been accustomed to use the water of that pump removed to Hampstead. She continued, however, to obtain her supply from it after she had removed, and was the first person attacked in her new locality. The case was investigated by a committee, the report of which contains evidence the most convincing that the poison of cholera found its way into the system through the drinking water. It was in fact discovered that the dejecta of a child affected with choleraic diarrhoea or cholera had been emptied into a cesspool only three feet from the well in question ; that the bricks of the cesspool were loose and allowed its contents to percolate into the well.

(g.) The English sailors at Baltchick were supplied with water from springs near which the French soldiers had been encamped, soiled the ground with excreta, and washed the clothing of comrades affected with cholera in the source of supply. Of 12,572 British sailors, 710 were on this occasion attacked by the disease in epidemic form.

(h.) In 1855, in the case of the French Division in the Dobrudscha, and English Cavalry at Devna, the water seemed to be the means by which the disease was propagated.

(i.) In 1859 at Glass Houghton near Pontefract, a portion only of the village was attacked. It was found that the inhabitants of that portion made use of water from a well polluted with faecal and other noxious matters.

(j.) In 1866, in the houses in Berlin supplied with good water, the cases of cholera were at the rate of 36 per cent ; in those supplied with bad, 52. In New Orleans the 116th Regiment of United States colored troops was moved into barracks. The supply of distilled and rain water for a day or so was scant, and some of the men used river water. Soon two cases of cholera occurred. Pure water was then supplied, and no further cases took place. In Halle, one part of the town supplied with good water remained free from the epidemic, but the pipes having burst, and the supply obtained from the filthy river, the Saale, a severe outbreak occurred. In Königsberg 122 attacks per 10,000 inhabitants occurred in the higher parts of the town supplied with good water, 777 in the lower parts supplied with that of the worst quality. In London the explosion of the disease was confined to an area supplied with water supplied by one particular company and from one particular source. It is important to observe that although in this instance the supply was carefully filtered, that process failed to render the water innocuous.

(k.) Before 1870 there had always been 3,000 to 6,000 deaths by cholera annually in Calcutta. In that year the new water works were opened ; the deaths fell to 1,560, in the following year to 790, and in 1872 to 600. Unhappily however it is again increasing.

(l.) In 1873, at Rosherville, Tennessee, dejecta from a cholera patient were cast upon a hill side and thus carried into a well. The water of the well, although offensive in odor and unpleasant in taste, was used by families in the vicinity, many of whom were attacked and died by cholera. According to reports, it was undoubtedly the contamination by this water that caused the outbreak of the disease, although, it is added, other causes excited an influence in promoting its distribution. At Grenville, Ten., not only were the sanitary conditions generally wretched, but

the water supply was fearfully contaminated. At least half the citizens were attacked. In Russia, towns having pure water supply escaped, while those with foul supply suffered. Portions of towns that had good supply escaped, while other parts around them, the supply of which was vitiated, were affected by the epidemic. The death of an English lady in Vienna by cholera, and spread of the disease in that city by means of water supply, are circumstances that attracted a good deal of public attention at the time.

7. The result of observations made during the four epidemics in France is to confirm the views entertained, that the occurrence of the disease is favored by contamination of water. On the one hand, there are writers who assert that water contaminated with organic matter likely to cause cholera, presents upon its surface molecular matter and vibriones, and is moreover amenable to the permanganate of potass test. Others assert that water containing cholera matter will alone produce cholera, that impure water, foul from other causes, but not containing this matter, will produce dysentery and typhoid fever, but not cholera.

8. In India and elsewhere, many instances are on record of the occurrence of cholera in persons who had drunk water that percolated through grave yards. In 1873 it is stated that of twenty-four cases of the disease in prisoners in the Jail at Yerrowda, the subjects had in twenty-two instances drank water from a stagnant pool in which natives performed their ablutions, and within twenty yards of which the bodies of two persons who had shortly before died of cholera had been burnt. During the epidemic of that year in America, cases where the disease was directly attributable to drinking water from grave yards were reported in Tennessee. An instance is further given. A party of laborers employed in an extension of the Mississippi Central Railway were encamped opposite Cairo, Ill. From the foot of a bluff near them a spring flowed, the summit of the bluff having for

years been used as a cemetery. The men cleared out the spring, after the interval of a day began to use the water, and on the following were attacked with malignant cholera.

9. It is considered that water which contains fresh cholera discharges is less dangerous than that in which molecular changes have taken place. If however this be a rule, exceptions to it are of frequent occurrence. Some writers assert that water is capable of producing the disease when consumed during the vibrionic stage of decomposition, but that it may be drank with impunity when this stage is over, and when various forms of ciliated infusoria have replaced the vibriones. The poison may be preserved by cold, hence it is believed the occurrence of the disease in Russia during the winter season from choleraic contamination of the snow from which the water supply is then obtained. It is believed by some writers that some outbreaks of cholera on boardship, the occurrence of which at the time could not be accounted for, were due to the circumstance that infected water had been taken on board. With the present arrangements for distillation, a similar danger could not arise. See lxxii. 7.

10. Of persons who partake of water polluted with cholera poison, the proportion attacked by the disease seems to vary according to circumstances. In India it is considered that one in five so suffers. An instance at Calcutta in 1861 is related where nineteen persons drank water which was subsequently ascertained to have been polluted with recent dejecta, and of that number five were within three days afterwards seized by the disease. The remaining fourteen were unaffected. In Russia in 1873 the proportion attacked after making use of contaminated water ranged from 1 in 6 to 1 in 9.

11. Numerous authors assert that contaminated water is rather a predisposing than exciting cause of cholera, that it produces the disease only when it is epidemic. In

Oxford, during the epidemic of 1854, the conclusion arrived at was that water was one but not the only means by which cholera was conveyed. At Newcastle, and in the case of the now famous Broad Street pump, it was not until the disease became epidemic in England that the use of contaminated water produced an attack.

12. Other writers adduce facts in support of their views against the theory of cholera even in epidemic seasons being spread by means of water.

13. According to them, the disease has spread in localities where contamination of the water could not possibly have taken place. Before, and during the epidemic at Neer much the best water was alone used; it was boiled and filtered, yet no abatement in the disease followed at the time. In 1867 cholera spread in several jails in Bengal, the water of which had been free from contamination. In the same year the epidemic appeared in places where, although the natives drank contaminated water, they had drunk the same water during twenty-three previous years, and yet all that time continued exempt from the disease.

14. At Peshawur in 1869 the native troops used water that was considered to contain faecal matter, and escaped. The British who used the same water were attacked, and at the same time the men of the 104th Regiment, whose supply was obtained from a pure well, suffered severely.

15. When in 1871, cholera became epidemic in the 18th Hussars at Secunderabad, the men were using the same water that they had previously used without evil result; other persons using it while cholera prevailed in that Regiment were unaffected by the disease. If therefore, as is supposed, the source had been contaminated by travellers, the fact still remains that, while one set of troops making use of it were attacked, another escaped. At Morar the

epidemic was local, being limited to the Royal Artillery who used water from one particular well.

16. During the epidemic of 1872, of troops at the same station making use of the same water, some were attacked by cholera, others were not. At Peshawur and Kohat, where the water was obtained from rivers, the course of the epidemic was much the same as at other stations, where the supply was obtained from wells. At Kussowlie the troops were moved to a short distance from barracks; they continued to use the same water they had always used, and yet the disease ceased. The boys in St. Peter's College at Agra used the same well water as a portion of the native community; they suffered terribly by cholera, while no case of the disease occurred among the natives. At Thyet Myo in 1873 cholera ceased among the horsekeepers of the Royal Artillery on their removal to a new site, although they continued to use the water of the well they had always resorted to. In the town of Madras, cholera is stated to have decreased in prevalence before the introduction of recent improvements in the water supply.

17. In Germany, some high authorities are opposed to the theory of choleraic water poisoning. They observe that no distinct evidence of its transmission thus occurs in relation to the outbreak in Munich, Bavaria, Saxony, Baden, or villages around Vienna.

18. There are also writers whose opinions are adverse to the occurrence of local outbreaks from the use of water, chiefly, as they observe, on account of the difficulty there is in reconciling with this hypothesis, certain exceptional cases both of immunity and attack.

19. The circumstance has been recorded by writers on cholera, that China has been relatively less severely devastated by the disease than India. In explanation it has been observed that the Chinese habitually make use of weak

infusion of tea, which they drink hot. Whatever degree of truth attaches to the opinion, it deserves attention.

LXX. IN RELATION TO FOOD.

1. In India, and it is assumed elsewhere, sporadic attacks of cholera, often fatal, are frequently caused by indulgence in particular articles of diet. In some instances the articles producing the attack are fresh. For the most part however they are in an unwholesome condition. Certain fruits, more especially cucumbers and pine apples, are deemed particularly likely to induce cholera in those who make use of them. Pork, fish, crustaceans and molluscs are also dangerous in India at all times, but particularly during epidemic seasons. Notwithstanding this, it is well known that certain classes of natives habitually make use of half decayed flesh as food, and that they are no more liable to cholera than others who do not. Certain fakeers who live on carrion supply cases in point. The Hill men of Chota Nagpore eat half decayed meat and yet are free from cholera. The use of drastic purgatives, emetics, and depressing medicines is looked upon in Bengal as calculated to produce cholera. The Constantinople Commission nevertheless holds by 11 votes to 7 that the transmission of cholera by means of articles of food has not been conclusively established; that is, by food wholesome in itself, but contaminated by the poison of cholera.

2. The following are instances illustrative of the relation existing between the production of cholera and the use of particular articles of food. They refer principally to the transmission of the disease by this means.

(a.) Prior to the outbreak of cholera at Delaware in 1832, an oyster boat arrived there, having on board the

body of a man who had died of the disease. All the persons who ate of the oysters took cholera, and fifteen died.

(b.) In 1848 a cargo of plums was declared to have spread the disease in Hull. The fruit had not only been exposed to epidemic influence, but handled by contaminated persons.

(c.) In 1849, during the epidemic in England, it began to be suspected that dried fish, pork, bacon, vegetables and fruit handled by contaminated persons were more active in causing cholera than fresh, ripe, clean fruits or vegetables, or nicely kept, salted or smoked meats.

(d.) In November 1871 some of the sect of Righurs or tanners held a feast at Delhi. The food, consisting of rice, lentils, clarified butter, sugar and spices, was laid upon a mat on which the body of a man dead by cholera had lain, and which had been soaked by cholera discharges while the patient lived ; the remains of the feast were sent home to the women and children. On the third day cholera appeared among the men and their families. Between that and the eighth day seventy attacks occurred, forty-four fatal ; the attacks distributed through fifteen families who had partaken of the food, all of them living at a distance from each other, and the disease being confined to them.

(e.) During the American epidemic of 1873, several instances were recorded in which meat and fruit handled by contaminated persons were believed to have communicated the disease.

3. Articles of food and of drink that have been kept for some time in a ward containing cholera patients are believed to acquire the capacity of transmitting the disease to healthy persons consuming them. Numerous instances are recorded in support of this belief. In 1873 a prisoner

in the jail at Yerrowda who had been in attendance on a fellow prisoner was himself attacked. He had not only continued in attendance upon the patient, but had taken his meals and drink beside him, these having been allowed previously to remain a considerable time in the ward.

4. Milk may be the means of conveying cholera through tainted water used in cleaning the vessels or diluting the milk. A sad instance in point occurred at Calcutta in December 1871.

5. Instances are recorded of nurses affected with cholera having nursed children at the breast and yet the latter remained free from the disease. As elsewhere observed, there are authors who question the possibility of milk being secreted during the attack by cholera. On the other hand, several instances were recorded during the American epidemic of 1873 in which nursing infants were attacked after their mothers had died. See xxxviii. 3.

LXXI. IN RELATION TO FAMINE. .

1. Numerous examples are recorded of populations reduced by famine being ravaged by cholera. Great famine and drought preceded the epidemics in Bengal of 1818, 1869 and 1870. The epidemic of 1866 in the Madras Presidency is believed to have owed its severity to the impoverished condition of the lower classes, to scarcity and indifferent food.

2. On the other hand it is observed that in the years preceding 1817 scarcity of grain had from time to time existed, cholera being absent, yet in that year when the great outbreak took place, there was no such scarcity.

LXXII. IN RELATION TO SHIPS.

1. It is considered that less danger arises from the embarkation on board ship of persons who have been in contact with cholera patients, than of such as arrive from foci of the disease. Also, that greater risk exists in regard to ships when they sail from infected ports during the progressive period of an epidemic of cholera, than when the disease is in its decline.

2. Although cholera does not necessarily occur on board all crowded ships, it is considered that the greater the degree of crowding, the worse the sanitary conditions, the greater the risks of a violent epidemic. Other favoring circumstances, include limited space, defective ventilation, and impossibility of isolating the sick from the healthy.

3. All classes of passengers are not equally subject to attack when the disease manifests itself on board. Cabin passengers are less so than those who travel in the steerage or on deck. In the ship *American Eagle*, from Liverpool, a large proportion of steerage passengers were attacked, while among those who occupied airy cabins not even a case of diarrhoea occurred.

4. When cholera occurs on board ship, more victims are usually carried off in the first few days of the voyage than afterwards. As the voyage is prolonged the epidemic becomes exhausted, not to reappear. The duration of the outbreak is usually limited to a few days; that in the French fleet, for example, only lasted ten. Troops and others, among whom cholera has occurred, but who are convalescent, may communicate the disease on landing after a short voyage. Their clothing and other effects may also be the means of propagating it.

5. It is considered that cholera has from time to time been introduced into the Hedjaz, by means of ships arriving from India and Java; to Suez by vessels from Arabia; and

that in every instance of the occurrence on the east coast of England, the first cases have been traced to the arrival of an infected vessel.

(a.) In 1819 H. M. *Topaze* conveyed cholera from Trincomalee to the Mauritius, the disease being actually communicated on that occasion by persons who were themselves convalescent. From the Mauritius the epidemic was conveyed to Bourbon by two slave vessels in December of the same year.

(b.) In 1829 the introduction of the disease into Jedda was traced to the arrival of pilgrim ships from India. The disease on that occasion followed the pilgrims in their passage up and down the Red Sea. In the same year it was traced as conveyed from Dantzic to Cronstadt by ships trading between those ports.

(c.) In 1831 it was brought to the Medway by ship from Riga.

(d.) In 1832 it reached North America by means of ships having on board cholera infected passengers. These landed at different ports, from which the disease spread in various directions by means of river steamers. Thus the *Constantia* from Limerick arrived at Grosse Island on the St. Lawrence on the 28th of April, the *Robert* from Cork on the 14th of May, and other vessels on the 3rd June, among them the *Carriicks* from Dublin. All these had cholera on board during the voyage. Many of the emigrants proceeded to Montreal and Quebec, became attacked in those cities, and spread the disease, which then for the first time, appeared in the great continent. In 1833 into Portugal by the steamer *London* from England.

(e.) In 1848 the ships *Swanton* and *New York* arrived at New Orleans from Havre. There had been a general overhauling of baggage on board ; cholera soon thereafter

appeared, and was introduced into New Orleans. The same year the epidemic reached London, Hull, and Sunderland by steamers from Hamburg; Leith by a vessel from Cronstadt.

(e.) From 1851 to 1856 cholera was on several occasions carried from India to Arabia. It was so, particularly from Bombay, by means, it is said, of native boats and sailing vessels about which no body cared; rarely by the large well equipped steam ships, except on the occasion of the Mecca festivals.

(f.) In 1853 many ships from infected ports arrived at New York; the emigrants passed onwards; the first cases of cholera appeared not at New York; but after an interval of some months at Chicago. On this occasion the infection seems to have been conveyed in their clothes, and only to have exerted its influence when the boxes containing the tainted articles were opened. See lxxiv. 10.

(g.) In 1854 cholera appeared in Quebec, five days after the arrival of the ships *Germania* and *John Howell* from Liverpool.

(h.) In 1865 cholera spread from Zanzibar northward to the ports of Brava and Mogdeesha by means of slave dhows; by the same means southward to Delgado and Mozambique. Although the health of steamers arriving at Suez with pilgrims from Jeddah was said to be good, it subsequently transpired that the steamer *Sydney* lost on that passage 100 out of 2,000 passengers. The epidemic did not show itself in any of the parts of the Mediterranean or Black Sea until after the arrival of ships from a primary or secondary focus. A ship carrying 1,500 pilgrims from Mecca arrived at Suez, several deaths by cholera having occurred on board. The steam ship *Ellora* from Alexandria arrived at Southampton on 23rd July, having on board 31 cases of acknowledged diarrhoea, besides many more in

ship were persons who concealed their condition in order to escape quarantine, but of whom one died in Southampton, after his son, who was taken ill on shore, had succumbed in the same house. The *Vectis* arrived on 21st September without cholera or diarrhoea on board, but having been in quarantine at Malta and Gibraltar. On 11th September the *Delta* arrived, having cases of choleraic diarrhoea on board. On the 10th of June the *Poonah* had arrived, also from Alexandria, Malta, and Gibraltar. Two days before the arrival of the ship several persons on board had become ill with diarrhoea, one dying of declared cholera, the cases attributed to foul water taken on board at Gibraltar. Twenty-three other vessels arrived from Alexandria before cholera broke out in Southampton. At Malta, on the same occasion, no bowel complaint appeared until after the arrival of pilgrim ships from Alexandria.

(i.) In 1866 cholera was carried to Ceylon by infected ships from India. The *Virginia* left Liverpool on 4th April and arrived at New York on the 17th, having cholera on board. The sick were placed in quarantine on Governor's Island; on 18th July cholera attacked the troops there, and from them spread. See lxxiv. 10.

(j.) In 1870 cholera was conveyed to Constantinople by ships from infected Russian ports. Seventy such vessels arrived, quarantine was strictly applied, and for a time with success, yet in 1871 the disease broke out and spread.

(k.) In 1872 the disease was conveyed by ships from Hamburg to London, Havre, Liverpool, New York, and probably to New Orleans. Also in 1873.

(l.) It is also remarked that the increased frequency of late years of cholera along the shores of the Caspian Sea is attributed to the increase of steam communication.

6. On the other hand the assertion is made that cholera has never been imported into Egypt by any of the steam

ships plying between Suez and Indian ports. It is doubtful to what extent the assertion is true. At all events, every arrival of a ship from an infected port, should, for the purposes of hygiene, be looked upon as a source of danger.

7. A ship coming from an infected locality, and on board of which during a long voyage no case of the disease has occurred, may be the means of introducing cholera into a port. Instance the *Virginie* and *Saint Marie* sailing in 1855 from Marseilles and Bourdeaux respectively to Guadaloupe. On the other hand, instances are on record of cholera existing on board a ship and yet not being transmitted by means of the crew. In the case of the *Carnatic* in 1819 some of the men who landed at Madras where cholera prevailed were attacked after re-embarking, yet none of those who nursed them or lived with them suffered. In 1854 cholera appeared in the *Britannia* sixteen days after leaving Varna, and the mortality was great; additional hands were supplied from an uninfected ship, some of the sick from the *Britannia* being transferred in return, yet in neither case did the crew in or from the uninfected vessel suffer. In this instance contaminated water was believed to have caused cholera. See lxix. 9.

8. The sanitary measures recommended in respect to ships in India include the following, namely:

1. *Before leaving a contaminated port.*—Precautions (a) in regard to anchorage, (b) the hold, (c) the water, (d) health of the crew.

2. *On the departure of the ship*—(a) health and capacity of the vessel, (b) sanitary state of crew to be embarked, (c) quality of provisions, (d) of water, (e) of articles of personal use, (f) of cargo, (g) the separation from all else of the luggage, &c., of troops.

3. *The voyage*—(a) surveillance of passengers, (b) ventilation throughout, (c) cleanliness of latrines, (d) separa-

tion of sick; (e) disinfection, (f) measures regarding those attacked with diarrhoea.

9. The important question may arise, "If cholera breaks out on board during the voyage, would it be better to continue the voyage or put in at a port?" It is considered that the continuation of the voyage does not appear to increase the danger; that it may therefore be continued, (a) if the crew and troops have already been subjected to the influence of a choleraic atmosphere, (b) if the place to which the ship is bound, and the season, admit of ample ventilation of the vessel, (c) if the state of health otherwise on board is good, (d) if the crowding is not great, (e) if the sick can be separated. Under contrary conditions it is considered preferable to return to the port of departure or put in at another port rather than continue the voyage. If one or more cases occur on boardship, the further measures recommended are, (a) bring the patients on deck, lay them upon a piece of sail cloth exposed to and surrounded by a free current of air, (b) let the evacuations be received in a vessel containing sulphate of iron, and immediately thrown overboard, (c) sprinkle disinfecting powder about the spot where the patients lie, and place sulphate of iron beneath the cloth on which he is laid, (d) limit the number of attendants and separate them and patients from the crew, (e) whatever be the issue of the case or cases, let all clothes and bedding used by the patients be destroyed, (e) let all the water issued from tanks be first filtered and boiled, or if condensers are in use, employ only water from them.

10. In 1853, twenty-eight ships sailed during the prevalence of cholera from England, Holland, France, Bremen and Hamburg for New York. They carried in all 13,762 passengers, of whom there died from cholera during the passage 1,141 persons or 83 out of every, 1,000. This illus-

trates the extreme virulence with which under particular circumstances the epidemic may prevail on board ship.

11. Under favourable circumstances, the occurrence of one or a few cases of cholera on board ship is not necessarily followed by a general outbreak. The ship *Ville du Havre* left Havre on September 12th, 1873, and arrived at New York on the 24th of the same month. One fatal case of cholera occurred during the voyage. The dejections of the patient were disinfected as soon as voided ; all soiled linen was burnt, the state room was cleansed and daily disinfected, with the result that no other case occurred on board. Similar measures were equally successful on board the ships *Washington* from Stetin and London, and *Havre*, from Havre and London, also to New York.

LXXIII. RIVER AND CANAL VESSELS.

1. There is danger in placing men on board boats from which others suffering from cholera have been recently removed. An instance is recorded of a regiment travelling down the Ganges in the native kind of boats formerly used in the transport of troops by river route in Bengal, meeting a detachment travelling upwards by the same means, and among whom cholera was raging. For some reason not stated, the two sets of troops changed boats. The disease seemed to cling to the infected boats. It left the detachment first affected, and attacked the troops, who until then had been free from the disease.

2 Numerous instances are recorded of cholera being disseminated by means of vessels of different kinds plying upon rivers and canals. Thus—

(a.) In 1818, cholera was believed to have been conveyed from Lower Bengal to Mirzapore by means of trading boats

on the Ganges. In subsequent years it was thus conveyed upwards, and also downwards along both that river, and the Jumna.

(b.) In 1832 its course was traced to boats from Breslau to Frankfort; thence by canal to Berlin; from Berlin down the Spree to the Elbe, and so to Hamburg. The disease was traced to boats from Edinburgh by canal to Glasgow. In North America it was conveyed in steamers carrying emigrants upwards along the St. Lawrence. A body of troops on board the steamer *Henry Clay* were the means of conveying the disease from Detroit to Cleveland, Ohio.

(c.) In 1833 it was carried northward along the river Mississippi by means of vessels, each town and city attacked becoming in turn a centre of radiation.

(d.) In 1841, the 15th Bengal Native Infantry while en route by rivers from Dacca to Benares, lost some men by cholera. They met the 45th Bengal Native Infantry coming down the river. The latter regiment had till then been healthy. The two fleets of boats anchored close to each other. The following evening a case of cholera occurred in the 45th Native Infantry, and the disease clung to the regiment until its arrival at Dacca, spreading then from it to the 32nd Native Infantry.

(e.) In 1842 cholera appeared with great violence in various fleets of country boats conveying troops upwards and downwards along the Ganges. The 9th Lancers became attacked near Monghyr, but on emerging from the infected district, the disease left it. This locality, and the banks of the river near Bhaugulpore, were at this time "hot-beds" of the disease.

(f.) In 1848 during the epidemic in Germany, on the approach of the disease to Berlin, the greatest number of attacks were among the boatmen on the river Spree, and in

the towns along the banks of that river. In America the epidemic was conveyed from New Orleans to Memphis by the steamer *Convoy*, to Nashville by the *Caroline Watkins*, to Louisville by the *Peytonia*, and so on. It was said of the steamers leaving New Orleans that they became so many pest houses, diffusing the epidemic over the valley of the Mississippi.

(g.) In 1849, cholera was carried from St. Louis to Chicago by means of a canal boat conveying emigrants.

(h.) In 1854 it was similarly carried from St. Louis to the head waters of the Mississippi, Missouri and Ohio.

(i.) In 1865 the steamer *John Gilmore* carried cholera from New Orleans to Cincinnati.

(k.) In 1866 the steamer *Texas*, with recruits from Hart's Island, left New Orleans on 19th July and arrived at Galveston, Texas, on the 22nd. The day after their arrival, cholera appeared among them and spread. It was similarly conveyed to Louisville, Kentucky; to Richmond, Virginia; and to La Virgine, Nicaragua Bay.

(l.) From 1870 to 1873 the traffic by canal boats between Odessa, Kiev, Königsberg and Dantzic as well as between other places was the means of disseminating cholera.

(m.) In 1873 the epidemic was carried northward along the line of the Mississippi river by infected boats, also by boats on the Arkansas and Ohio. In Caseyville the first cases of the disease were traced to persons landing from an infected steamer. It was similarly conveyed by boats and steamers along the Champlain and Erie canals, spreading from them by means of other steamers in all directions. In Russia it was conveyed to St. Petersburg by means of boats along the Volga from above Moscow and Iver.

LXXIV. THE THEORY OF PANDEMIC WAVES.

1. The argument in regard to pandemic waves seems to be somewhat after this manner. There is a general belief that the ordinary climatorial, endemic, and personal causes are insufficient to account for the variations in the prevalence and fatality of disease. There seems, so it is stated by advocates of the theory, to be a series of waves, generated in southern latitudes, which, independent of human intercourse flow to the north or north-westward in succession, and lead to the occurrence of various diseases, cholera among them, as they pass. A cause therefore, extending as this is stated to do, over continents and seas, is more correctly named pandemic than epidemic.

2. It is observed that the nature of the pandemic wave and its mode of action are both difficult to be defined. It is assumed however, to have a constant course in the Atlantic and western part of the Indian Ocean.

3. It is said to be an interesting subject of inquiry whether the pandemic cause acts on the system, rendering it more susceptible of the influence of the ordinary causes of the disease, or on those causes themselves, giving origin to a more concentrated, or a different kind of poison, which generates a more virulent, or a new form of disease; or whether it affects both, increasing the activity or altering the kind of the causes.

4. A succession of such waves is stated to proceed at intervals from the southern to the northern hemisphere. These intervals are said to be two or multiples of two years; also that the more serious outbreaks of disease occur sometimes in the *odd* years, sometimes in the even.

5. There are said to be several stations situated in their respective zones, that the wave does not reach until a period of the year, when the local causes of disease are comparatively quiescent.

6. The influence of these waves in causing outbreaks of disease is said to be manifest in two ways; first, under the operation of the same wave in the same year at points very different in latitude, and embracing in longitude, it may be, almost half the circumference of the earth; and second, in successive years at points more and more to the northward as the waves pursue their usual course.

7. According to the author of this theory the ship *Mangles*, sailing from England to India in 1814, entered the region of the pandemic wave six weeks after her departure from port; cholera attacked her passengers then, and continued to prevail until her arrival in Table Bay, sixty-four dying by the disease. Against this theory however the facts are cited that for six weeks previous the lascar crew of the vessel had been fed upon rice and salted herrings, that their daily allowance of water had been only half a pint, the sanitary state of the forecastle fearfully bad. The recorded symptoms of the disease on board are more those of scurvy than of cholera. The same author seems to attribute the occurrence of the disease in the Island of St. Helena and in the West Indies in 1818 to the passage of the wave over those places.

8. In 1849 Her Majesty's ship *Apollo* sailed from England on 17th June, having the 59th Regiment on board for Hongkong. It is on record that cholera had shortly before occurred in the barrack from which the troops had embarked, and that the disease had been prevalent in the neighbourhood of their quarters. It appeared among the troops on board on the 18th and continued until the 11th August, when the troops were landed at Rio Janeiro. The case of this ship is hardly typical, as it is said to be, of the influence of a pandemic wave.

9. On 21st January 1864 the *Queen of the South* sailed from Bombay with invalids and their families. On the 24th

diarrhoea occurred among them, and it continued to prevail during the subsequent days. On the 1st February cholera broke out and continued till the 16th of that month, when the ship arrived in Table Bay and the epidemic ceased.

10. On 28th March 1866 the ship *England* left Liverpool with emigrants for New York. On the 2nd April cholera occurred at sea. In respect to the *Virginia*, *Helvetician*, *Peruvian* and *Union*, sailing from the same port, a similar occurrence took place. Other instances are also recorded in illustration, but in all it appears possible to account for the occurrence of the epidemic without the intervention of the theory of pandemic waves. See lxxii. 5-f.

LXXV. TRANSMISSIBILITY BY CLOTHING AND BEDDING.

1. International Commissions affirm that cholera is transmissible by means of clothing and bedding used by persons affected with that disease ; by articles in domestic use that have been soiled with discharges ; that when clothing is kept packed up and excluded from the air the "poison" of the disease may be conveyed to a great distance.

2. The following instances are selected in illustration, viz. :

(a.) In 1832 cholera at Moor Monkton near York was believed to have been conveyed to that place from Leeds by means of clothing. Fifteen days after the death of the owner, the box containing the articles was opened, and the man by whom it was so was seized with cholera. As the river steamer *Voyageur* was proceeding along the river St. Lawrence, a bed on which a passenger had died of cholera, was thrown overboard. It was picked up by a boatman,

who took it to his house. Within twelve hours afterwards he was dead by the disease, no case of which had up to that time occurred in the locality. A chest of clothing that had belonged to a sailor who died of cholera at a Baltic port, arrived at his home in a small village near Bangor, State of Maine. The chest was opened, the clothing distributed among his friends. All who received the garments were taken ill with cholera and died.

(b.) In 1849 thirteen emigrants arrived at New York from Sweden and proceeded direct, via Buffalo, to Chicago. They there unpacked their clothing; two days afterwards cholera appeared among them and spread. A vocalist died of cholera in a hotel in Quebec. A waiter, from cupidity, carried the clothing of the deceased to the jail where his son was turnkey, and hung them up in a room used by the officers of the jail and their families. Next day the waiter died by cholera; a man whom he had visited died, and the bed of the latter being sent to be cleaned, the man who cleaned it took cholera and died.

(c.) In 1851 a vessel arrived at Grand Canary from Havanah where cholera prevailed. She had a clean bill of health. A washerwoman in San José took to wash a mattress and clothes, the property of a poor passenger, and she and her children slept upon them all night. They all were attacked with cholera and died. The disease spread; it caused 9,000 deaths among the inhabitants of this small Island, beginning on the 30th of May, reaching its height on the 10th of June and beginning to decline on the 13th of that month. In this instance the outbreak of the disease occurred fourteen days after the bedding and clothes had been landed.

(d.) In 1853 cholera was believed to have been introduced into Cessantes near Vigo by means of infected clothing. A poor woman living on the shores of the Moray Firth had a son in Glasgow. He died of cholera there. His clothes were sent by steamer to his mother. She washed

them. Before they were dry she was seized with cholera and died. At the time no other case of the disease had occurred within 200 miles of her.

(d.) In 1854 bedding and clothing were considered to have been the means of conveying the disease from Oxford to New Hankney. The first case in the village of Ridgemoor county of Bedford occurred in a man whose son had died in London, and whose clothes being sent to his house were opened by his father, the man attacked. His case was the focus for others. Cholera was similarly introduced into Schleisham and Lustherm near Munich. In the latter named town the first case occurred in a family whose daughter had sent them from Munich clothes that had belonged to persons who had died of cholera. In the month of May the ship *Dirigo* with a small number of emigrants arrived at New York. On the passage she took thirty passengers from a wrecked vessel from Liverpool; they had only saved the clothes upon their persons, and on arrival at New York, being healthy, they all obtained free pratique; yet some of the first cases of cholera in that city were traced to them.

(e.) In 1865 cholera is believed to have been introduced into Galazita by men who had picked up a cloak, the property of a person who had died of cholera, and that had been thrown away. At Avila in Spain it was attributed to a soldier who, while passing through Madrid, where cholera at the time prevailed, had purchased clothing there; while at Avila, he put out to dry as it had become wet during his journey. The epidemic was considered to have been introduced into Seville by means of soiled clothing, the property of sailors arriving from infected ports. Into Halifax the same year by means of clothing that had floated on shore from the ship *England* and was attacked. The ship *Saint Marie* arrived at Guadeloupe from Bordeaux, where at the time of sailing cholera prevailed. One death took place during the

voyage. On reaching port a young man went on board, and brought on shore with him a parcel of clothes for a washerwoman. Two days afterwards he was attacked and died. Three days more, and the washerwoman died, then a child who had been with the first case ; then the washerwoman who had washed at the same place as the woman first attacked ; and then the disease spread in the island.

(f.) In 1866 a medical man relates that after a severe day's exertion he went home in the clothes in which he had been attending a cholera patient in Delaware city, undressed and hung them up in his wife's room. The following day she had diarrhoea, which soon culminated in severe although not fatal cholera. Disinfection and isolation were adopted, with the result that the disease did not spread.

(g.) On 5th July 1873 the ship *City of Limerick* arrived at New York from Liverpool with emigrants from Holland, having sailed from Liverpool on 31st May. Some of the emigrants proceeded direct to Carthage, where they first unpacked their boxes on 15th July. Cholera speedily thereafter appeared among them and spread. At Chattanooga a woman took away some cholera soiled clothes and washed them ; she took the disease and died. At Greenville a negro man stole from a house that had been abandoned on account of cholera some articles of clothing, and took them to his own home. Within three days he, his wife and their three children had cholera, from which the wife only recovered. In Jackson, Miss. : a girl employed with a family in the town was taken ill with cholera and died. Her own family lived some miles in the country. Soon after her death her father and mother arrived to see her. They took her bedding home with them. One week afterwards they and their five children took cholera, and all except the father died.

3. Persons employed in sorting and washing articles of clothing soiled by cholera patients are considered to run especial risks of being attacked by the disease. Water in which such articles are steeped or washed is believed to acquire thereby dangerous properties.

4. Instances in illustration are the following, viz. :

(a.) In 1854 during the epidemic at Oxford, eighteen washermen were attacked by cholera,

(b.) In 1866 at Leipsig sixty-two laundresses were attacked, of whom twenty died. In one hospital in Moscow the man who received the clothing of cholera patients when admitted, another who dispatched them to the laundress, and the "doctor" who counted them, were all seized with diarrhœa. Numerous other instances are adduced on the same occasion of the disease being similarly propagated.

(c.) In 1873 several deaths took place at Nashville among washerwomen who had washed the clothes of cholera patients, at a time that no other cases of the disease appeared in the town. In the city of Carington, a woman who had washed clothing that had been shut up during ten days after the death by cholera of its wearer, was attacked by the disease and died.

5. Instances are recorded indicating that persons have contracted cholera by sleeping in beds or wearing the clothing of cholera patients. Doubts exist as to whether bedding or clothing that have not actually been used by, but merely hung up in the room of a person ill with cholera, are capable of transmitting the disease. All such must, however, be looked upon as dangerous.

6. Notwithstanding the instances related, others are brought forward by writers in support of their statements that cholera is not under all circumstances thus propagated. It has been stated that during the several epidemics of the

disease in England, persons employed in washing clothes did not suffer in any special way. At Calcutta, of five natives who wash and keep clothing soiled with cholera, none died by that disease in twenty-five years. In France during the epidemic of 1855, a man in despair at the death of his wife dressed himself in her chemise and went to bed in the bed from which her body had just been removed, yet was not attacked by the disease. The results of experiments upon condemned criminals in Russia had similar results; the malefactors were dressed in the clothes of cholera patients and placed in beds in which persons had died by the disease, yet they remained unaffected.

LXXVI. TRANSMISSIBILITY BY MERCHANDISE, LETTERS, &c.

1. International Commissions believe that no case is known establishing the transmission of cholera by means of bales of fresh goods, or other articles of merchandise from one country to another. The circumstance is dwelt upon that merchandise from India, landed at Suez or conveyed direct to England, has never been known to have transmitted the disease. It is observed however that the possibility of the disease being so conveyed is allowed by the Commissions. An impression exists in the northern part of the Madras Presidency that cholera is transmitted by means of native manufactured salt. The subject is being inquired into. If it be so transmitted, does the cholera poison adhere to the salt, or is it contained in the water of crystallization ?

2. That rags and clothes contaminated by cholera discharges may be the means of conveying the disease is generally acknowledged. They are accordingly considered very dangerous.

3. Nor are instances wanting in support of the belief that bales of goods may be the means of conveying the disease. On 18th June 1833 a wagon laden with merchandise arrived in Lancaster, Ky. They had been purchased in Philadelphia, whence they had been conveyed partly by steamer and partly by wagon. Before their arrival, there had been no cholera in Lancaster. They were unpacked and placed in a store. The following day the owner of the store was attacked, and from his residence the disease spread in the town. In 1865 cholera is said to have been introduced thus into Alicante, with goods smuggled from Marseilles.

4. An instance is related by the Constantinople Commission, where the choleraic principle was believed to have remained latent during a month in some sheep skins shut up in a box. In 1865 cholera was considered to have been introduced into the island of Palma by means of a case of wool smuggled by a Spanish ship from an infected locality.

5. It is considered by Commissions that letters, newspapers, and dispatches may possibly become contaminated by being touched by persons suffering from cholera, and thus convey the disease. No instance occurs however of this having actually taken place.

LXXVII. TRANSMISSIBILITY BY LIVING ANIMALS?

1. According to the opinions expressed by International Commissions there is no proof that cholera has been conveyed by living animals. It is considered however reasonable to look upon them as susceptible objects, and accordingly at Maltamea sures are taken as if animals were capable of transmitting cholera.

2. It is asserted that inasmuch as animals that have inhaled cholera matter have become affected by the disease,

and communicated it to others, it is reasonable to believe that they may, under favouring conditions, transmit the disease also to man. A belief exists in India that the disease may be propagated by means of pariah, and village dogs that feed upon garbage and refuse.

LXXVIII. TRANSMISSIBILITY BY DEAD BODIES.

1. The International Commissions of 1866 and 1874 affirm, that cholera may be transmitted by, or from dead bodies of victims of the disease. Individual authorities express similar views; some asserting that corpses of those dead by cholera are very active propagators of the disease; also that cholera may be communicated thus in post-mortem examinations, more especially where some time has elapsed after death. Funeral parties are forbidden by the military authorities in India, in consequence of the acknowledged liability of soldiers who form them to be attacked.

2. Instances are related of workmen employed in exhuming bodies of persons dead by cholera being attacked by the disease, as those dead by plague and small-pox have been the means of propagating those diseases. Similarly, cholera has been considered to prevail persistently in buildings erected upon disused grave yards. This circumstance is considered to have been the cause of the great unhealthiness of the barracks at Rajghat, Benares. At Bristol a burying ground in which were many dead, some by cholera, was surrounded by houses, and in them cholera raged with peculiar violence. At Goose Island, Illinois, some buildings were in course of erection upon ground where shortly before some of the dead by cholera had been buried, their graves being then removed; the disease immediately appeared among the workmen and spread.

3. At Teheran cholera broke out in September 1854, that is, in the month when the bodies of the dead were being exhumed to be carried to the holy shrines. There were among them bodies of persons who had died of previous cholera. The occurrence of the disease is said to have ceased as soon as the exhumation ceased, but places through which the pilgrims passed with those bodies became attacked by cholera. In France, during the epidemic of 1855, bodies of persons dead by cholera were looked upon as sources whence the disease might be propagated.

4. In 1865, the caravan by which cholera was conveyed to Meshed Hussin and Meshed Ali was itself unhealthy ; bodies of persons who had died by the disease being carried with it for interment at those shrines. Similar occurrences have been recorded on other occasions.

5. In America, observation, particularly in Tennessee has induced the belief that a cadaver was capable of generating a specific poison peculiar to cholera, and upon which the propagation of the disease depends. In 1873 at Caseyville, a man who assisted in placing the coffin of a friend dead by cholera in the grave was attacked by the disease and died. At Chatanooga the boy who drove the wagon that conveyed the pauper dead took cholera and died. Of ten men employed to bury the dead five took the disease, of whom three died. Near Montreal, a fisher took on shore in his boat the body of a passenger who had died of cholera on board a river steamer, not knowing the cause of death. The same night he took ill and died, as also his wife and a nephew who had come to the house to visit them.

6. It is observed on the other hand that corpses carried by pilgrims to Mecca do not always produce cholera. It is allowed however that the miasm arising from them is an aggravating circumstance when cholera prevails among the

pilgrims. Thus the presence of the bodies of such as have died by the disease must be looked upon as dangerous.

7. The circumstance is dwelt upon that on occasions, medical men who perform post-mortem examinations of dead by cholera have not suffered in undue proportion. It was observed during the Crimean war that those employed in this duty were not specially liable to be attacked by this disease. At Cronstadt in 1829 it is recorded that of thirty grave diggers employed in burying the dead by cholera, all escaped without attack. In the Anatomy School of Glasgow in 1832, 48 and 49, on which occasions nearly all the subjects had died of cholera, not a single attendant suffered from the prevailing affection. Many other instances similar in nature occur in reports on this disease.

LXXIX. IN REGARD TO DEJECTA.

I. As it is in the intestinal canal that the morbid agent of cholera seems to be generated, so alvine evacuations are its most general and powerful vehicle. That they are so is almost universally believed to be a fact. Choleraic evacuations are considered to be tainted with an organic infecting matter, which must gain access to the intestinal canal of another person before he can be attacked by cholera.

2. It is considered that evacuations in the early period of the disease are more dangerous than those of a later period of the attack ; also, that those of persons, themselves free from the disease, but who have come from an infected locality, may produce the disease in others. Freshly voided dejections are believed to hold the choleraic principle in a latent state, a certain degree of "fermentation" being considered necessary for its evolution. It is accordingly considered that dejections are most dangerous during the process

of decomposition ; that in this respect they resemble some animal poisons, as that of pyemia, &c.

3. The morbid principle once evolved becomes dangerous by obtaining admittance to water, and also it is believed, by diffusion in the atmosphere. Cases are on record of medical men and attendants being conscious of inhaling poison with the characteristic odor from evacuations, an attack of cholera quickly succeeding. The occurrence of cholera at Old Ford in 1866 was clearly traced to contamination by this means of the river Lea. Numerous other instances of a similar occurrence are on record. See lxix.

4. Dejecta of a single cholera patient cast into a common sewer may become the means of poisoning several houses at once, by the gases flowing back from the latrine, and thus carrying the principle into the apartments of the dwelling. In this way it is believed the disease may be conveyed along one side of a street to the exclusion of the opposite. In 1866, at Bristol, a screened passage separated two wards, each occupied by thirteen men. In one were seven cases of cholera and six deaths, in the other, only one case. The men had the same food and water, but the inmates of the stricken ward were healthy men who frequented a tainted privy while the others were sick, all except one who went to the same privy as the others died, and he was attacked with cholera.

5. Unfortunate dogs have, it is asserted, for the good of humanity, been exposed to emanations from cloacæ, with the result that they have been seized with vomiting and purging. It does not appear whether the object of such experiments has been to indicate that man may become affected with cholera by similar exposure, in the absence of choleraic dejections in the cloacæ, or the converse.

6. It is considered "almost proven" that evacuations in a dry state are more dangerous than in the wet. The pro-

perties of the organic matter of cholera may, it is said, be retained for years, while if kept in a wet condition, the matter is after a time rendered harmless. It thus appears that a danger may exist in regard to the use of dry earth; it may deoderise evacuations, but the infecting properties of dejecta may be preserved by it. It is also asserted that as vibriones do not evaporate, they exist in greatest numbers in evacuations that have become desiccated, thus increasing the danger from this source.

7. The result of observations in France and Scotland in 1849, indicates that the effluvia from the excretions of a person affected with choleraic diarrhœa may communicate to another person predisposed thereto, the most fully developed form of the disease.

8. It is further believed, particularly by observers in America, that the earliest diarrhœa stage, when it occurs in persons with foul breath, and an offensive condition of the digestive organs, is more infectious than that of the clear rice water discharges; also, that great danger lies in the offensive evacuations in the consecutive, or typhoid state following the disease.

9. It seems to follow, that the cleaning out of latrines and sewers at the commencement, or earlier stages of an epidemic often favors the propagation of the disease; also, that as far as possible, dejections should at once be disinfected and removed in closed receptacles. The safest mode of disposing of them is, after disinfection, to bury them at a distance from houses, and from the sources of water supply. See DISINFECTANTS.

10. Against the views here expressed, it is observed that the pernicious nature of evacuations does not appear to have been even hinted at by the older writers on cholera. This assertion, however, is only in part true. In 1685 cholera and desentery were both considered capable of being

propagated by emanations from latrines. Instances are frequent in India of sweepers and washermen enjoying absolute immunity from the disease throughout an epidemic, nor do they appear in that country, at any time to suffer in greater proportion than persons not so employed.

11. Cholera is known to have spread where evacuations have been dealt with in accordance with indications of the theory of their dangerous character, and in others to have ceased where they have not been so dealt with. The conclusion arrived at is accordingly, that although cholera evacuations are undoubtedly capable of communicating the disease, yet in many cases they remain innocuous. For the purposes of Army sanitation, it is well to consider them as being most dangerous.

LXXX. IN RELATION TO ASSEMBLAGES OF PEOPLE.

1. Large assemblies of people, whatever be their purpose, are generally considered to be among the surest agents of propagating cholera. They are believed to be so not only in India, but in other countries also. When however, the disease attacks such bodies in epidemic form, it prevails only for a definite period, then disappears, unless fresh arrivals of persons in conditions favorable for attack by it take place. On their dispersion, persons who had been present at them may propagate the disease far and wide.

2. In the French epidemic of 1855, the assemblage of intending emigrants at Havre became a source of propagation of the disease. In India it has so often appeared on the occasion of fairs, that the suppression of such assemblies has been made subject of discussion. In October 1866, it appeared in the camp of the Governor-General's Agent at Jodhpore ; in November in the camp of the Governor-General at Agra. The epidemic continued to prevail in the

Terai throughout the following winter, and in April 1867 broke out with great violence in the assemblage at Hurdwar, spreading thereupon in various directions.

3. It is considered that the more unfavorable is the hygienic condition of the persons constituting an assemblage, especially in India, the more prone to attack they are, and the more severe the disease is likely to prove among them.

4. Whether the disease originates among them or spreads from an imported case, becomes a matter for study in each particular instance. In all countries it is difficult to trace the exact history of epidemics, but especially so in India. It is considered, however, that emanations, both exhalant and secretive, together with other collective pollutions evolved from persons in large assemblages conduce, in India, to cholera.

5. In 1818 cholera became very prevalent at Punderpore while strangers were assembled there in great numbers on the occasion of the great religious festival in July. At Nijni Novgorod in 1869 it broke out at the time of the great fair, with the arrival of 200,000 merchants from various parts of Russia, from Persia, and from Central Asia. Many other instances are also on record.

6. On the other hand, cholera does not of necessity occur in all assemblages of people. Indeed, its occurrence is the rare exception not the rule. It is observed also that on the occasion of the great outbreak of the disease in 1817, no large gatherings of people took place anywhere in Bengal or Northern India; that of fourteen fairs at Hurdwar since 1857, all except three have passed without cholera making its appearance; and that in 1867 cholera appeared in the Terai below the Kemaon hills before it occurred at Hurdwar. Did pilgrims then carry the disease to Hurdwar? Whence came it to the Terai? Did it originate *de novo* among the crowds assembled at Hurdwar?

LXXXI. IN RELATION TO WAYS OF
COMMUNICATION.

1. The principle is laid down and for the most part accepted, that cholera spreads everywhere in proportion to the facilities and multiplicity of communication ; its immediate agents being assemblies of people and individuals. In 1817 and 1818 the epidemic in India followed the great highways of the Deccan, often against the monsoon, communication between villages attacked by it and infected persons being in all cases traceable. In 1832 it was carried from the St. Lawrence along the lines of communication. In 1854 the epidemic in North America spread widely everywhere from the large cities ; it principally followed the train of emigration, and thus reached the remote settlements of the west. On the same occasion, in consequence of increased facilities of travel, Denmark, Switzerland, and Greece, protected during twenty years by quarantine, were overrun by the disease. In Persia, the highway of cholera has ever been found to be also that of commerce and pilgrimages. In India, as communication has become more constant and rapid, so has extension of cholera in that country become greater, the outbreaks more frequent. Throughout Europe, the tendency is recognised of the disease to follow the great highways of commerce, including navigable rivers and frequented routes ; also that in its progress, instead of taking the shortest route, it follows that of greatest communication.

2. But there are circumstances of an opposite nature. It is observed that in 1817 the facilities of communication were no greater than they had been for years before, and for years afterwards ; yet for nearly half a century prior to that date no extensive outbreak of cholera is on record ; also, that the Indian epidemic of 1872 was not specially propagated along the great lines of communication.

LXXXII. IN RELATION TO RAILWAYS.

1. International Commissions have expressed an opinion that next to means of transport by sea, railways are the most active agents in the rapid extension of epidemics of cholera. In this way the disease has appeared at Alexandria after the arrival there of pilgrims from Suez. On 19th May 1865 the first ship of the year with pilgrims from Jeddah arrived at Suez. Many had died of cholera during the passage. After landing at Suez a large number went by rail to Alexandria. On the 22nd, cases of cholera occurred among those en route. On the 2nd of June the first recognised case of the disease occurred among the inhabitants of Alexandria, who were in communication with pilgrims. From them the disease spread in all directions. It is thus clear that the disease was conveyed by passengers travelling by rail in this instance. In the same year, cholera was introduced into Altenburg in Saxony by a traveller who had gone by rail from Odessa, where cholera was raging, without having stopped anywhere in the interior, the house occupied by the family of this patient becoming a focus, from whence the epidemic spread in the town. In 1869 the first four fatal cases in Toula near Moscow occurred in a railway carriage. In the same year the disease extended from St. Petersburg south-west to Warsaw along the line of rail between those places. It similarly extended from Pesth to Trieste, Treviso, and Genoa.

2. They also observe that although railway communication is capable of carrying the disease with greater rapidity from one place to another, it is less adapted to propagate an epidemic with such certainty as ordinary communication. The circumstance is stated without explanation in regard to its probable causes. In India the observation has been made, that epidemics of the disease do not travel faster since the introduction of railways than they did before their introduction. In 1872 the epidemic was not

specially propagated along the great lines of communication, nor did it travel more rapidly than it had done before the introduction of railways. It is stated, however, that on that occasion policemen, and other employés on the railway, were attacked by the disease, in larger proportions than were the ordinary population of places, where they were stationed.

3. This point has been carefully worked out in America. In 1832 cholera was considered to have been conveyed from Lexington to Frankfort, Ky., by means of the railway between those places. In 1849 it was carried by emigrant trains from Texas and Missouri upon the plains known at that time as the great American desert. In 1854 a car full of emigrants arrived at Colombia, Pa: from Philadelphia. Two or three of the emigrants had cholera. They were placed upon the platform of the railway station. Some gentlemen waited upon them there; within forty-eight hours the patients and those who attended upon them were dead, and the disease spread in the town. In 1866 the railway trains conveying troops, carried cholera rapidly to every post on the Arkansas river and other places to which they were proceeding. In 1873 the disease spread from Chattanooga along the lines of railways, the towns at which trains did not stop remaining free from the disease; nearly all the villages along the line from that place to Nashville suffered in turn. In Tennessee various instances are recorded in which the disease first occurred at junctions among employés, or in the places frequented by them. Reports state that the first case in Caseyville occurred in the child of a railway employée: that the epidemic was introduced into Washington county, Ill., by persons arriving by rail from infected places; that the disease travelled along the line of the Ohio and Mississippi railroad.

4. It was not possible in all cases, however, to trace the communication of the disease by such means. Tennessee, in which cholera prevailed in the summer of 1873, is 500 miles

from Denison, and no direct communication exists between the two places. After its prevalence in Tennessee the epidemic spread in Kentucky, then in Missouri, then in Boonville, 680 miles from Denison, and on the same line of rail. Thus the exceptional instances are very few.

5. But if railways are considered to be means of propagating cholera, the circumstance is also acknowledged that rapid removal of troops by rail ensures by a maximum of dispatch, the reduction to a minimum of the susceptibility to attack. In Indian epidemics, troops have been removed from infected stations by rail to distances varying from thirty to eighty miles, and with the result of escaping further attack. It has been recommended that camping grounds should be selected along the lines of railway at distances of fifty to seventy miles from cantonments, to which the troops could be rapidly moved to them on the occurrence of cholera among them in barracks.

6. The following sanitary suggestions in regard to white troops travelling in India have been adopted from a code laid down by a Madras Committee in 1868, viz. :

(a.) No body should travel for more than twelve hours continuously by rail.

(b.) The customary meals of the troops should be ready, cooked and waiting for them, at the station where they will probably be at the usual hour appointed for such meals.

(c.) When large bodies are thus moved, they should travel by special train, at as high a rate of speed as is consistent with railway arrangements.

(d.) The trains should stop not less than once in four hours for a period of half an hour, at places previously determined on.

(e.) At such halting places an ample provision of good drinking water should be provided ; no articles of food of any description should be permitted to be offered for sale

by natives; the troops should only be allowed to leave their carriages for necessary purposes, and then, not to wander beyond the platform or enclosure. Sufficient arrangements for their necessities should be made before hand, the telegraph being employed to give full and timely warning of all that may be required from station to station.

(f.) When halting for meals, the men should be restricted from access to adjacent bazaars or towns, and from communication with natives in or about the station.

(g.) Separate and suitable accommodation, with all other necessary arrangements, should be provided in the train for sick brought on with the troops.

(h.) One or two empty vans in addition to those occupied by troops should form a portion of the train. These should contain a suitable number of paillasses, ready for use in the event of any person being suddenly seized with cholera.

(i.) Each large party should be accompanied by a medical officer, with supply of medicines and appliances.

(j.) The subordinate Medical establishment, in proportion to the strength of the body of troops, should be accommodated in a separate carriage or compartment, rendered conspicuous by a suitable placard.

(k.) On the occasion of the periodical haltings of the train, the medical officer in charge should inquire as to the state of health of the troops in each separate compartment and carriage.

(l.) The trains should, if possible, run between 6 A. M. and 6 P. M.; sufficient time of day light being allowed before and after halting, to enable them to make all necessary arrangements, whether for the journey or for the rest.

(m.) When men halt for the night, the ordinary sanitary precautions are to be observed for camp or quarters, according to the arrangements made for their accommodation.

(n.) When different bodies of troops meet at a particular station, the senior medical officer present will take charge of, and be responsible for, the united party.

(o.) When a portion of the troops branch off at a particular station, the senior medical officer present will give to the medical officer or subordinate proceeding with them, the necessary instructions for his guidance, taking care also that he is provided with sufficient medicines and appliances to meet probable requirements.

(p.) The necessity is inculcated of carefulness at halting places, that the source of water supply be kept pure, that water for the use of troops be preserved in clean vessels, and only for the time necessary for the requirements of the men. Also, that trenches or other means resorted to by the troops are carefully disinfected after use, filled in with earth, or otherwise obliterated or cleaned. Similarly, the camp ground or huts used by them will be constantly preserved in a wholesome condition.

(q.) Medical officers will note the number and description of carriages in which cases of cholera occur, so that the Railway authorities may take steps to have them disinfected.

(r.) In the case of bodies of troops arriving from other Presidencies, timely communication should take place between the officer in command of each party and the Quarter Master General's Department, to enable the latter to make sufficient and timely arrangements.

These observations however, have no official weight, nor is it intended that they should in any way interfere with orders issued by authority on the subjects to which they refer. In some respects indeed, they have been made the basis of such rules.

LXXXIII. IN RELATION TO PILGRIMS.

1. Pilgrimages are in India and other eastern countries considered the most powerful of all causes of cholera epidemics. In Persia and Mesopotamia, they are described as being the propagating agents par excellence of the disease.

2. Pilgrims are generally considered to be in the conditions most calculated to render them susceptible of the disease. They are dirty, weary, hungry, often under the influence of strong emotion, and other depressing influences of both a moral and physical nature. They often sleep together in bodies, two, three or more, under the same blanket, their food is for the most part scanty and of inferior quality, the water they use contaminated.

3. The question seems still open to inquiry, whether the outbreak of the disease among them, when it does take place, arises from importation, or occurs from causes existing in their own persons. For the most part it breaks out among them two or three days after their assemblage. In some instances it spreads no further than their own mass; sometimes the dispersing pilgrims carry the disease with them to distances extending to 300 miles, disseminating in in some cases, in others not.

4. It is recorded that in 1781 epidemic cholera broke out at a pilgrim fair at Travancore. On that occasion the disease does not seem to have spread, but during the eight days it continued, destroyed 20,000 persons. Between 1781 and 1790, troops en route from Bengal to Madras became, on several occasions infected by cholera at Ganjam, from pilgrims assembled at that place.

5. Out of five epidemics which have desolated India since 1830, two have coincided with the return of pilgrims from Mecca, namely, that of the hot season of 1831, and that of 1865, and both are believed to have been introduced

by returning pilgrims. There is much evidence also, that the extension of the disease in Persia, Russia and Europe, in the several epidemics in those countries, has taken place through the medium of pilgrims. At Mecca the disease is considered to be always imported among pilgrims. In 1821 cholera was carried by pilgrims from Bagdad and Hillah onwards to the Mediterranean. It has frequently been similarly conveyed from Bussorah to the holy shrines of Arabia, by pilgrims from India and Persia, carrying with them thousands of their dead for interment. In India it prevails nearly every year, in places of pilgrimages throughout the three Presidencies of Bengal, Madras and Bombay, and from them is considered to have been at various times distributed in all directions.

6. In 1783 the disease is recorded to have occurred at the Hurdwar fair, but to have died out without propagating itself as the pilgrims dispersed. In 1860 the disease appeared in a congregation of pilgrims at Mahadeo in the Puchmurree hills, and was by their dispersion disseminated in all directions. In 1863, it occurred in a caravan of pilgrims en route to Ayodiah, between Allahabad and Fyzabad. Their sick and dead were left at Pertabghur, Sultanpore and Fyzabad, each of which places afterwards became a nucleus of the disease. In 1864 the outbreak in Madras town was considered to have been propagated from pilgrims returning from festivals at Conjeveram, Triputti, Trivellore, &c. In 1865 that in Bushire, to a caravan from Kerman. In the same year it is stated to have been introduced into Mecca by pilgrims from India: to have radiated thence to Alexandria, and by the human current to Beyrout, Sapurna, Constantinople, Malta, Ancona, and Marseilles—extending even by ships across the Atlantic. Of 90,000 pilgrims at Jeddah, Mecca, Meenha and Arrafat, 30,000 fell victims to the disease during this year. In 1867 cholera followed the pilgrims from Hurdwar to Almorah and other places in

India, and northward to Cabul and Affghanistan; on that occasion the towns and villages through which they passed were most severely attacked, and mostly in the order in which they were reached. It appears however clearly ascertained that cholera was this year carried to Hurdwar by pilgrims from the foot of the Himalayas, Benares, Allahabad, &c. In 1869 it was thus introduced from Triputti into Mysore.

7. But instances are, according to some reports, by no means rare, in which connection cannot be traced between the occurrence of cholera in a locality, and its introduction by pilgrims or other persons. No such connection could, it is said by some Indian writers, be found in regard to the outbreak of the disease in Peshawur in 1867, or in Rajpootanah in the same year. Did such connection on that occasion actually exist? Was the disease introduced by ordinary travellers? or did it originate locally? The facts are these: It was ascertained that 548 men, women, and children left Peshawur for Hurdwar; that 524 returned, so that 24 died while en route, of cholera and other diseases. Besides this, Peshawur is on the high road to Cabul, between which and Hurdwar great numbers of pilgrims went and returned.

LXXXIV. IN RELATION TO TROOPS IN MOVEMENT.

1. When cholera attacks a body of troops on the march, the disease developes itself rapidly, although less so than on board ship. It for the most part is quickly extinguished, provided fresh arrivals do not join. When fresh arrivals take place, a decreasing epidemic may regain its original violence. This happened in the case of troops at Varna and Gallipoli in 1854.

2. The liability of troops on the march in India to attack by epidemic cholera is a generally recognised fact. This liability seems to be greater in the Madras Presidency

than in either of the others. The central districts of Madras are those in which troops on the march are most liable to suffer, including the Collectorates of Bellary, Cuddapah and Kurnool. This remark applies to natives and to occidentals. Statistics of the former give the following results. In the case of detachments 18 per cent. of marches were attended by cholera ; 31 per cent. in cases of bodies, 1,000 and upwards strong. In the smaller bodies the rate of mortality per mille when attacked was twenty-four ; in the larger forty-eight. Out of 108 marches lasting less than twenty days, nine were attended by cholera ; of ten lasting from 100 to 120 days, five were so attended. Of 144 marches under 200 miles, 130 escaped cholera. Of 222 extending from 200 to 400, only 164 were free from the disease. Of twenty-seven from 600 to 800 miles, only eleven escaped, while out of six marches from 800 to 1,052 miles, only two escaped. Madras sepoys however are accompanied by their families and crowds of followers.

3. Troops while marching have become infected from meeting bodies of pilgrims, or of other troops suffering from the disease. In some instances they have carried the disease with them, getting rid of it on entering barracks. This happened in the case of the 63rd Regiment at Bellary. It had suffered extremely during the greater part of its march from Poonah to the latter place, but lost the disease two or three days after entering barracks there. In others they have got rid of it on getting beyond the infected mass. It has been picked up by troops marching through a district in which the epidemic prevailed ; it has clung to them for several weeks, either in its epidemic character, or in the form of sporadic cases.

4. The larger the body of troops marching together, the greater is considered to be their liability to attack by cholera. Similarly, the longer and more fatiguing the marches performed continuously, the greater is this liability. The

truth of these principles was, it is believed, exemplified in the case of the 86th Regiment prior to the epidemic that so severely visited it at Kurrachee in 1846.

5. Troops in motion may not only contract cholera from the civil population, but be the means of disseminating the disease in distant places. Among numerous instances illustrative of their liability to be attacked are the following, viz. :

(a.) In 1739 the invading army of Nadir Shah when near Delhi was severely attacked by cholera.

(b.) On 22nd March 1781 a body of Bengal troops marching downwards along the coast were, when at Ganjam, suddenly attacked with great violence. They were halted at Ichapore, with the result that the epidemic was immediately checked.

(c.) In 1790 a body of troops was similarly attacked at Ganjam.

(d.) In 1808 the troops at Meerut are considered to have become affected from the civil population. In this instance however, only a few cases occurred among the military.

(e.) In 1814 a body of soldiers arriving at Calcutta was thus attacked.

(f.) In 1817 the Marquis of Hastings with 10,000 white and 80,000 native troops had his army in three divisions, at Saugor, Jubbulpore and Munollah. The disease attacked them, having, it is believed, extended from the infected cities of Benares, Allahabad and Mirzapore. Much mortality occurred, but the force being moved to the high ground of Gwalior the epidemic ceased.

(g.) In 1818 a body of white and native troops marching from Delhi through Meerut to Hansi carried cholera from

the former to the latter place, communicating it to the troops encamped there. The force that captured Chanda seventy miles from Nagpore marched to the latter named place, being attacked with cholera en route and carrying it with them.

(h.) In 1821 while cholera was raging in Bagdad, a Persian army menaced that city, defeating the Turkish defenders. In a few days the Persians being attacked by the disease, recoiled from the city, retiring with fearful mortality to Tabriz, whence the pestilence was propagated by the troops to Kasbin, Zengan and Maraga, from each of which it further spread.

(i.) In 1829 cholera was conveyed from Orenberg to Kazan by a body of Russian recruits. The armies of the Khan of Khiva were engaged in a campaign against the Persian province of Khorassan, but were forced to retire in consequence of the occurrence of cholera among them.

(j.) In 1830 the Polish revolution occurred. Masses of Russian troops were accordingly put in motion. After the battle of Iganie on the 10th of April, many prisoners, arms, and much clothing fell into the hands of the Poles, who thus became affected with the disease. After they had been defeated they retreated into Austria where they laid down their arms, but carrying cholera along with them, the disease broke out with great violence in Galicia.

(k.) In 1831 the movements of troops in connection with the revolution continued still to be the means of disseminating cholera throughout Poland.

(l.) In 1832 the epidemic was conveyed by troops from Buffalo to the upper Mississippi.

(m.) In 1833 the civil war in Portugal led to the transmission of cholera by troops to the towns of Torres Vedras, Caldas, Leisia and Coimbra.

(n.) In 1840 the disease was conveyed from India to China with the force sent to the latter country, whence by means of caravans it spread westward to Kiachta, Russia, Burmah and Thibet.

(o.) In 1847 by means of a large Russian force it crossed the Caucasian mountains at a height of 6,000 feet, affecting the villages en route. It followed the Russian troops into Moldavia, and was propagated by a Turkish army along the banks of the Danube. In Russia itself, troops of that empire communicated it to Kisliar.

(p.) In 1848 cholera reappeared with great violence when large armies of Hungary, Russia and Austria took the field, numbering in all 800,000 men. It followed them into Hungary, Austria and Italy. Smolensk and other Russian towns through which troops affected with cholera passed, or in which they left their sick by the disease, were seriously visited by the epidemic.

(q.) In 1849 the 8th United States Infantry arrived at New Orleans on its way to Texas. From New Orleans they were sent by steamer to Lavocca and thence by march. They became severely attacked after leaving the latter place, and conveyed the disease into Texas.

(r.) In 1854 the French troops carried cholera from Marseilles to Varna, whence it spread to the Piræus, and from the latter extended in various directions. In the same year it was imported into the Crimea by means of the French fleets and steamers.

(s.) In 1855 the epidemic having appeared among the French troops at Maslak, it spread from that place to Pera and various other towns on the Bosphorus.

(t.) In 1865 the Prussians brought back with them many sick and wounded from Bohemia, among whom diarrhoea and cholera were common. Their forces having

entered the cholera zone near Altenburg, they caught the disease, and in their turn were the means of conveying it into Bohemia and Bavaria, when the epidemic passed on to the Austrian and Bavarian troops. In the same year some Prussian troops came to Halle from Stettin on the Baltic, and placed forty sick in hospital. The disease did not then spread, but a little later, other Prussian forces arrived from near the Baltic, carrying with them cholera, which then extended.

(u.) In 1866, after the battle of Waldbrunn, the Prussian forces occupied that town. Many became attacked there with diarrhoea and cholera, and having left it, cholera almost immediately broke out with violence among them. In America the disease was diffused through the southern and western states by means of troops. It extended from emigrants per ship *Virginus* to troops; by them to other troops in Newport Barracks, and spread, adhering to detachments sent to Louisville, Nashville, Memphis, &c. Recruits from New York carried the epidemic to New Orleans, whence it was carried to Texas, Richmond and other places. It was introduced into Persia by troops returning from Turkistan; and from Persia the disease rapidly spread to Turkey.

LXXXV. IN RELATION TO ANIMAL LIFE.

1. The simultaneous occurrence of large flights of locusts and other insects, and prevalence of cholera has been recorded in regard to several epidemics in India. In 1687 a French ship arriving at Masulipatam passed through dense masses of insects as they approached the coast; on arrival at that port the factories were found empty in consequence of the ravages of a plague which is considered in all probability to have been cholera. In the more recent epidemics

in India, the occurrence of large flights of locusts has been observed in several instances to precede or accompany the outbreak, an unusual development of insect life in others. At Umballah a severe outbreak of cholera was preceded by a great and unusual occurrence of earth worms. It is open to inquiry however, to define how far such circumstances are dependent upon the same cause; how far they are coincidences. Flies are believed to be a means of conveying cholera poison from dejections, &c., to the healthy, and thus to propagate the disease.

2. In France and elsewhere it has been observed, that swallows and other birds have deserted places immediately before the occurrence of an outbreak of cholera among the population. The fact seems established. Not so apparently the degree to which the departure of birds corresponds with the period of their regular migration; how far it takes place at other periods. In the latter case only can the phenomenon be associated with cholera or its cause.

3. It is recorded that at Goa a severe epidemic raged in 1543. It was common to all classes of people, no less the child at the breast than the octogenarian: to the stalled beast and the domestic fowl, for it was common to all things living; nor, it is added, "could any reason be assigned for this agonising infliction." In 1829, when the 49th Regiment, then stationed at Berhampore, suffered from cholera, the fish in the adjoining tanks sickened and died in large numbers; dogs also suffered from an epizootic, the precise nature of which is not stated. For some time prior to that year there had been epizootics among the cattle at Orenberg. In it cholera occurred as an epidemic. During the prevalence in Scotland of the epidemic of 1831-32, a remarkable mortality among birds was observed. In 1869, concurrently with the epidemic in South Canara and Malabar, the coast for miles was strewn with myriads of dead and dying fish. Similar mortality among fish in the same

locality has been described as occurring in previous years, but it is not stated how far the phenomenon was concurrent with the prevalence of cholera as an epidemic.

5. Cholera has been stated to attack certain quadrupeds, more especially horses and dogs. At Lucknow in 1872 the horses of the 19th Native Cavalry are described as having suffered from a disease, in all respects similar to cholera, during the time that disease prevailed among the troops there. Dogs have been said to suffer from pure cholera, although the fact has been denied by other writers. Cattle and horses are believed to take cholera from feeding on grass irrigated with sewage containing its germs. In Tennessee it was considered that swine, rats and mice became affected from eating excrementitious matter, and that flies contaminated what food they touched. During the epidemic there these insects died in great numbers.

6. It has been proved experimentally that cholera dejections may transmit cholera to animals; also, that animals so affected transmit the disease to other animals of the same species. This circumstance, it is stated, is not considered sufficient to establish the identity of the disease in men and animals, although it is reasonable to consider the latter susceptible objects. White mice have been subjected to experiments with cholera matters. Thirty-four of these creatures were made to eat paper moistened with cholera matters in the first day of the disease. From that time till the ninth day afterwards thirty became sick and twelve died. Unfortunately however, it is added, in these the symptoms were not identical with those of cholera. In 1875, while cholera prevailed in Delhi, seventy-five cats in that city died from an affection presenting all the symptoms of that disease. Experiments were on that occasion performed, which seem to indicate beyond reasonable doubt, that the disease was propagated to healthy cats in some instances at least, by cholera matters. See xxxi. 1.

LXXXVI. IN RELATION TO PLANT LIFE.

1. In the older works on cholera it is stated that "in all great plagues which have affected the human race, other animals and even vegetables have borne their share in the calamity; the pestilential principle has extended to every principle of life." "Corn is blasted on the most fertile plains, the fruits in gardens and orchards wither, or fail to arrive at their usual perfection." The coincidence of blights on cereals with outbreaks of cholera has been recorded in several instances in the United Kingdom and elsewhere. In theory it is stated that from what is observed of vegetable blights, it is probable that the molecular germs of zymotic disease are more rapidly developed in the stagnant motionless state of the atmosphere, during the prevalence of which cholera has been said on various occasions to have prevailed in England.

LXXXVII. IN RELATION TO TREES AND GROVES.

1. Trees, whether planted so as to form a belt or as groves, having the reputation of interrupting *malaria*, they have been asserted to similarly impede the dissemination of cholera.

2. It is asserted that cholera is less prevalent in the well wooded parts of the Malabar coast than in the more arid parts of the peninsula included in the Ceded districts. In the former the results of fifteen years gave 4.6 per cent cases of cholera as compared to all other diseases; in the latter 55. A similar rule is said to hold good in respect to other parts of India.

3. At Gorruckpore in 1869 the disease prevailed in the town, but did not extend to the station occupied by the native troops. A belt of trees separates the one from the other, and to its presence the exemption was attributed.

Prior to a date some thirty years ago, Tinnevely was subject to frequent and severe attacks of cholera. The missionaries have plentifully planted trees upon what were then bare spaces, and it is asserted that, since the trees have grown up, the frequency and intensity of cholera there have both decreased.

4. On the other side of the question it is observed that during the epidemic of Jessore in 1867, natives who occupied huts surrounded by hedges and in dense forests suffered more than others who were not similarly circumstanced. The question having been submitted also, whether trees did exercise an influence in retarding the dissemination of cholera, 188 replies were received in the affirmative, 39 in the negative, and 254 left the matter doubtful.

5. There seems however, to be no difference of opinion as to the advantages of shade and protection afforded by trees when troops have, on account of cholera, to be moved into camp.

LXXXVIII. FIRES IN RELATION TO CHOLERA.

1. The belief has been entertained that the presence of fires on a considerable scale is antagonistic to cholera. In India such an impression is entertained. Wood fires are there recommended to be burnt to windward of cholera camps.

2. In the epidemic at Bellary in 1859, coolies occupied about lime kilns were said to be exempt. Some writers have accordingly recommended that on the occurrence of cholera, fires should be lighted throughout the cantonments or other locality affected. This measure was put in force at Bombay in 1819-20 and 21. On those occasions tar and sulphur were burnt in the streets, but nothing done to clean the latter; cannons were also fired to clear away the

supposed aerial influence ; also at Nusseerabad in 1869, but in both instances, without any particular effect. It is reported however to have given confidence to the natives. In the town of Salem in 1875, it was also employed with similarly negative results.

3. In the village of Theinnat in France the epidemic of 1865 suddenly disappeared after the occurrence of a fire which consumed several houses.

LXXXIX. IN RELATION TO HYGIENIC CONDITIONS.

1. Insanitary conditions of persons or places are held to favor the occurrence of cholera in them. Although they do not of themselves produce the disease, they increase it when introduced. Such conditions include misery and its concomitants ; also famine, fatigue, overcrowding, &c. Wherever sanitation is neglected, there cholera becomes concentrated and intensified. Crowded cities, heat, and general insanitary conditions for the most part coincide with the outbreak of the disease. The denser the population to the square mile, the greater the comparative mortality. In England a population of 915 to the square mile gave 65 deaths per 10,000 ; of 235 per mile, 7 per 10,000. Free ventilation is one of the most effective sanitary measures against cholera ; whereas, were the disease air borne, free ventilation would afford the readiest means of letting the disease into dwellings.

2. In the several epidemics that have visited England, places that were generally insalubrious suffered the most severely ; also those in which population was most dense. In London, it is recorded that no case occurred in buildings that were well drained and ventilated, with clean and abundant water supply, suitable water closets and dust shafts. At Lambeth, with the great works of sanitation, the prevalence and severity of the disease have diminished. At

Fisher-row, near Edinburgh, in 1830-31, cholera attained great violence; the houses had no windows or chimneys; the smoke issued from, and light and air were admitted by the same opening in the roof; the floors were of earth and filthy to an extreme degree. At Maidstone, in 1848, the epidemic prevailed violently among the hop pickers. They were crowded in a room that yielded to each only fifty cubic feet of space. Even in the most insanitary conditions, all persons do not suffer alike. Individuals and particular places are attacked, while others, to all appearance under similar conditions, escape.

3. In India it was observed that the Baniyas at Guntoor who, during the epidemic of 1819, occupied the only wide street of that town, almost entirely escaped, while the Brahmins who occupied a close and damp street, suffered severely. The epidemic of 1850 at Malta clung mostly to the narrow filthy streets. In the town of Madras the yearly deaths by cholera from 1861 to 1866 ranged from 15 to 30 per 1,000 of the population; after the introduction of sanitary improvements which then took place, it decreased between 1867 and 1871 to 1 and 4 per 1,000. At Fort St. George, in 1870, the men of 1/21st Foot who occupied a barrack in the north-east angle, where the main sewer of the town discharges into the sea, were the first to suffer. In 1872, during the Indian epidemic of that year, many of the stations attacked were reported to have defective drainage.

4. Throughout Russia generally, during the epidemic of 1829, it was observed that in places densely peopled, and in houses of the most miserable kind, the *infection* and malignity of the disease were greatest; that in places containing few persons, and where the houses were spacious, they were less so. In Moscow, the greatest mortality occurred in confined apartments, where the lower classes were crowded together, addicted to debauchery and filth. In Warsaw, during the epidemic of 1830-31, the disease seemed to be

contagious, or at least infectious in the old and filthy parts of the city ; the sick became foci of emanations, infectious even to the robust.

5. In America, when cholera was brought into communities, among which hygienic regulations were in force, the disease was in many instances stamped out. In New Orleans, in 1832, the epidemic first manifested itself among the dissolute, those without wholesome food and raiment, occupants of damp, filthy crowded parts of the upper Faubourg. In New York in 1861, that is before the introduction of sanitary improvements had taken place, of 15,000 prisoners, 524 died by cholera ; in 1863, after the introduction of improvements, of 15,520 prisoners, 156 died ; in 1867, when the improvements had been still further perfected, of 15,100, only 31 died ; in 1869, out of 18,500, the deaths were 83 ; and in 1872, out of 16,700, there were only 43. In that country as in England, the very practical remark has been made that it is far cheaper to effect sanitary improvements than to support widows and orphans of victims of diseases, aggravated by their neglect.

6. But there are writers who observe that the neglect of hygienic measures can be only auxiliary to cholera, and by no means its cause ; that in many instances the distribution of cholera does not appear to be regulated by conditions of sanitation ; that tracts of country sometimes escape, the conditions of which are insanitary, while it prevails where they are the opposite.

7. In 1849 the healthiest and purest parts of Middlesex, Hertford, Buckinghamshire and Kent suffered by cholera. On the same occasion the disease is reported to have prevailed less extensively in the Quartier Popincourt and Faubourg St. Antoine in Paris, than in the more healthy and open districts of the city. In 1855, although often, the places visited by the epidemic in France were in an unsatisfactory state, the opposite was the case in others ; some

of those attacked moreover were in no worse state than others that were spared, some notoriously unhealthy escaped, while others similarly circumstanced, and in their immediate vicinity, suffered. In 1864, at Constantinople, the galley slaves who were located in the *bagne*, where all the vilest sanitary conditions were massed together, escaped, while prisoners, soldiers and marines under their more favorable conditions, suffered severely. In America, it has been observed from time to time, that the epidemic often attacked persons who lived in healthy localities and obeyed all the requirements of hygiene. In St. Louis, Mo, the epidemic was confined to the north and south parts of the town, where sanitation was most perfect. Passing over the centre, where it was less so. In Kentucky, the remark was made that sanitation was as good when cholera appeared, as it had been in years when the disease did not occur. In 1866, while in Calcutta general diseases of zymotic origin decreased, as was believed, in consequence of sanitary improvements in the city, an increase took place in the occurrence of cholera. From then till 1871 there has been a steady decrease of the disease there. From the latter date till 1875 a steady rise, notwithstanding the introduction of the drainage system and that of water supply.

8. Not only does cholera sometimes attack places apparently free in all respects from sanitary defects, but it is observed that sanitary works are often incapable in themselves of destroying the predisposition to cholera. Thus in Constantinople the disease is now more severe than it was thirty years ago, before such works had been begun; so also it is with regard to India.

9. Some general conclusions have been arrived at by the International and other Commissions in regard to these important questions. Thus, according to the Constantinople Conference, although hygienic measures will not of them-

selves suffice for the destruction of cholera, they act progressively, and their influence is sure and indubitable ; they also do much to diminish the violence of the epidemic.

10. In France the result of experience of four epidemics has been to show that no kind of locality or class of persons remained free from the disease ; that although in some places, where hygienic and social conditions were most favourable, the occupants suffered most severely, nevertheless, cholera has prevailed most where the hygienic conditions have been bad ; want of air, crowding, insufficient clothing, food and privation, have all conduced to it.

11. In Europe generally, the larger proportion of deaths, as a rule, correspond with the degree of vitiation of the local atmosphere, by the products of decomposition or the habitual use of contaminated water ; so a diminished mortality coincides with the improvement of hygienic conditions of air and water, and sanitation of the soil.

12. It is laid down that sanitation of the disease should include—1, measures tending to maintain the purity of air, supply of pure and abundant water, and to prevent contamination of the soil by organic matter ; 2, instantaneous disinfection and removal of evacuations ; 3, frequent visits to barracks and to quarters of married families. All precautionary sanitary measures should be taken before hand. The necessity of constant preparation to meet danger indicates the maintenance of stations and barracks in the most favorable condition. Sick by cholera should be treated in airy tents whenever the season permits. In the plains of India this may be done at all times.

XC. IN RELATION TO CONSERVANCY AND CLEANLINESS.

1. In 1817 the outbreak of cholera in Jessore was considered to have a connection with collections of filth, stagnant pools and dense jungles. Steps were accordingly immediately taken to remedy those conditions. By a considerable number of writers, the circumstance that the disease is endemic in India is attributed to the fact that for ages the soil of the country has, as a result of the habits of the natives, been saturated with the products of their decomposing excretions.

2. But, on the other hand, in 1849, the healthiest parts of Middlesex, Hertford, Buckingham and Kent, did not escape. From 1854 to 1867, cholera was absent from Hurdwar, although in that interval the state of filth of that town continued the same. In the latter year the first attempt was made to improve its conditions, and then the disease occurred with great violence. At Lucknow, in 1867, people in the immediate vicinity of filth depôts did not suffer more than others; and in those surrounding the largest and worst there were no deaths. The filthiest parts of Lahore and Gwalior escaped, while the disease was raging at Meean Meer and Morar. Many native villages are in a filthy condition, and yet within the memory of man they have not been visited by cholera. The immunity of the filthy Ghetto at Rome is another instance.

3. The quantity of absolute filth produced yearly by man is very great. It has been calculated that it amounts per individual to lbs. 74·8 of *fæces*, and lbs. 941·6 of urine. Unless suitably disposed of, these accumulate in the mass, taint the air, penetrate the soil, and contaminate the water.

4. In England in 1832, persons appeared to suffer in proportion to the contamination of the air they breathed with the odor of water closets, and immunity from these

appeared to secure immunity from cholera. Thus the fact is in some measure explicable that the pestilence sometimes passing over slums and rookeries, attacked the houses of the more comfortable residents. During the epidemic in India of 1848, the result of observations was that the existence of dépôts of filth, and of foul obstructed drains was a perilous source of mischief. At Halle, in 1865, buildings having bad privy arrangements suffered most ; next, such as were badly ventilated and damp. In 1866 the extension of the disease over Lambeth almost exactly followed the direction of the water courses, especially such as were converted into sewers. In America, on the other hand, during the epidemic of 1873, it was observed that the presence of filth, either locally or generally in a town, did not affect its prevalence. The village of Bridgeport, a ward of Wheeling in an island in the Ohio, was in a filthy condition, when the epidemic of 1833 broke out, yet the epidemic first attacked Wheeling, the state of which was clean ; shortly afterwards however, it extended to Bridgeport, in which its ravages became frightful. On the other hand, Hoonsoor, in the Mysore country, having been one of the most noted haunts of cholera in Southern India, was placed under a system of thorough cleanliness and other sanitary measures, with the result that it is said to be next to exempt from the disease.

5. The distinction intended to be drawn in these remarks between questions of Hygiene and mere scavenging or conservancy is with a purport. The fashion of the day is to allude to scavenging as if it constituted the whole sphere of Hygiene. It is doubtless an important item of Hygiene, but only one item. Army Medical officers at times describe the sanitary condition of barracks as being satisfactory, whereas they mean no more than that those buildings and their surroundings are clean. The expression as thus used is misleading. It is moreover imperfect.

6. The following remarks, made originally by a Medical officer of the local service, have a special significance at the capital of the Madras Presidency. "The Cooum river winds very circuitously through Madras, and in its meanderings nearly encircles the village of Chintaudrepett. The river was made a necessary of by hundreds of natives daily throughout the year, and when the monsoon was heavy, and the bottom of this augean stable was thoroughly cleansed, no ill resulted from it; but if the monsoon failed, and the river remained uncleansed, when the hot weather returned, the water became low, and the filth at the bottom was exposed to the heat of the sun, the smell was most offensive, and an attack of cholera was the certain result, its only victims being the inhabitants within a short distance of its banks." At the date of publishing this volume matters are less desperate than they were when the above notes were first written. They are however still in an unsatisfactory and dangerous condition. Government House is close upon the banks of, and directly exposed to the emanations from the river, and within the space of a few years the Presidency has had to deplore the loss of two rulers, one by cholera, one by typhoid fever. The condition of the river in question is accordingly a matter of pressing importance.

XCI. THE QUESTION OF QUARANTINE.

1. With regard to the general subject of quarantine, two questions have been proposed for consideration by International and other Commissions. The first is, do quarantine and other restrictive measures cause less or more damage to the general well-being of a people than the scourge of cholera? the second, can measures of quarantine and isolation of the infected be so applied as to be effectual?

2. Political and financial considerations interfere with the application of quarantine measures, sufficiently stringent in

nature between different countries, to render the measure absolutely effective.

3. According to the Constantinople Commission, an "opinion exists, rightly or wrongly, that measures of quarantine are powerless against the propagation of the disease." It is further observed that they interrupt commerce, legitimise fear, and by no means protect against the disease. Quarantine, it is observed, has always been futile for arresting an epidemic; it is beset by insurmountable difficulties, and when insufficient, is worse than useless. In the history of cholera also, numerous instances occur in which the disease, although introduced into a locality, does not spread, notwithstanding that intercourse between it and the general population is unrestricted.

4. In reference to cholera in Russia in 1852 to 1855, it was observed that the transit of the infection, or poison is only dangerous when in a given locality there exist all the favorable conditions to the further spread of the poison. When such favorable conditions exist, quarantine measures cannot prevent the transit of the poison; when they do not exist, the cholera poison cannot obtain fixity, and the epidemic will not spread in spite of human intercourse. Consequently, quarantine measures in this case are useless.

5. Quarantine measures may be employed stringently to one line of access, at the same time that another is left open. For example, land routes may be thus protected, while sea ports are unguarded, or *vice versa*. Thus, cholera was communicated through France to Piedmont, and from the latter by land to Tuscany, and yet the ports of Genoa and Leghorn were under quarantine. In 1831, strict quarantine by land was maintained between Russia and Poland, yet Dantzic was open to ships arriving in large numbers with supplies for the Russian forces. The consequence was that cholera was introduced by that channel.

6. On the other hand, it is asserted that quarantine, if established upon a rational basis and in conformity with scientific principles, may be efficient as a barrier against the invasion of cholera. In the island of Reunion in 1819, a complete cordon was established round the hospital of St. Denis, in which many patients suffering from the disease were accommodated, with the result that the disease was stamped out. In the Mauritius, where such precautions were neglected, it spread through the island, causing 7,000 deaths. In 1831, and 1865, as well as on other occasions, Peterhoff and Palermo are considered to have been preserved from cholera by means of strict quarantine. By strict quarantine Denmark was saved from cholera till 1850, although Russia, Prussia, Sweden, Norway, England and Holland were respectively attacked on sundry occasions. In 1852, all quarantine regulations were removed. In 1853, cholera obtained admittance, and Denmark lost 4,737 lives by the disease. The general concurrence of Medical officers of the American army in regard to the epidemic of 1856, in the United States, is strongly in favor of quarantine. See viii.

XCII. QUARANTINE BY SEA.

1. International Commissions inculcate the importance of quarantine by sea, and have laid down elaborate instructions in regard to the manner of carrying it out.

2. In order however that it may be successful, it is necessary that the measures connected therewith shall be effectively observed.

3. The length of time during which it should be applied is held to vary according to circumstances. The Constantinople Commission considers that ten days is a sufficient

period in all cases, and twenty-four hours in the case of vessels arriving off a voyage, if they have been clear of the disease for thirty days.

4. *a.* In 1818 the crew of the *General Hewitt*, being prevented from going on shore at Diamond Harbour, where cholera at the time prevailed, escaped the disease, while the crews of all other ships in the harbour suffered.

b. In 1831 Grand Canary was visited by cholera. The island was cut off from all others of the same group, with the result that the disease did not reach them. In the same year strict quarantine was not observed at Grosse Island in the St. Lawrence, with the result that cholera was introduced into Quebec, and spread, not only in that city, but from it as from a focus.

c. By quarantine by sea, Greece escaped the epidemics of 1830, 1837, and 1848, with the exception of the island of Sathos, into which the disease was introduced through a violation of rules. In 1854, apparently in consequence of imperfect application of measures, cholera was permitted to enter the Greek islands, and a cruel epidemic was the result. Sicily, which suffered like Greece in that year, escaped in 1856, by refusing communication with ships. In 1865 the disease was introduced into Delos and Sciathos by ships arriving from Alexandria and other infected ports. On the same occasion, the islands of Mytelene, Rhodes, Crete, Samos and Sicily protected themselves from the disease by means of strict quarantine. Synope, Varna and Burgas seem to have been protected by similar means. At New York in the same year, quarantine was strictly maintained to the complete exclusion of the disease. The ship *Atlantic* arrived in that port from Havre. She carried 540 steerage passengers, all of whom had passed through Paris, that city being at the time infected, although Havre was not. On the day the ship began her voyage, a child died by cholera, and before arriving at New York fifteen deaths

occurred among the steerage passengers, although not one of the crew or cabin passengers suffered. The vessel was placed in strict quarantine on arrival, and although fresh cases occurred on board, the disease did not extend beyond the infected ship. See lviii. 6-9.

α. Cholera having been introduced into the island of Guadaloupe, Dominica was put in quarantine, with the result that although two cases of the disease were imported into the latter, the disease did not spread. In 1866 Sicily was protected by means of strict quarantine, although the disease was epidemic at Marseilles, Genoa and Naples.

5. At Delgado, also in 1865, effective measures of quarantine averted the threatened attack of cholera from Zanzibar for some time; whereas the islands of Comoro and Johanna, where no effective quarantine could be established, suffered; Nassy Bey and Myotta under more effectual measures escaping.

6. By means of quarantine measures properly applied, although in 1870-71-72 many ships arrived in England having cholera on board, yet on each occasion the disease was stamped out. The vessels came respectively from Riga, Odessa, Dantzic and Havre. On 27th August 1873 the ship *Westphalia* left Hamburg; she touched at Southampton on the 30th, and reached New York on the 10th of September. Eleven cases of the disease occurred in two German families during the passage; on arrival at New York the patients were placed in hospital on Dix Island, the excreta disinfected, the soiled clothing burnt, with the result that no further case of the disease occurred.

7. But many places that have been visited by cholera ships have escaped in the absence of all quarantine measures. Imported cholera is not always transmitted. To be so requires "auxiliary conditions," which happily are not always met with. The question is also asked, Did

the most vigorous measures of quarantine prevent the appearance of cholera in London, St. Petersburg or Spain in 1832, or in Naples in 1836? Must the reply be in the negative? In 1831, when the disease was brought to the Medway by ships from Riga, no case occurred in the crew of war vessels in the former until nearly three weeks after the arrival of those infected. At the end of that time the disease appeared in those that lay anchored nearest to the vessels by which the disease had been imported. In October 1836 the epidemic appeared at Naples, then in strict quarantine. Malta was under strict quarantine, yet the disease occurred at Valetta, whence it spread over the island, appearing about a month later at Gozo. See xxvii.

XCIII. QUARANTINE BY LAND.

1. It is considered that in order to render their isolation complete, it is necessary that there be not less than 200 to 300 metres of clear space around the places occupied by cholera patients.

2. It is asserted that such isolation, when it is practicable, has effectually protected the healthy. As illustrations, it is recorded that when in 1829 cholera occurred near Orenberg, the inhabitants of a hamlet, only eighty yards from a place where it raged, shut off all communication and escaped. At Astrachan in the same year many villages, farms and gardens cut off all communication and remained free, although the disease raged all around. In 1831 the Imperial Court of Russia, including 10,000 persons, was thus protected. In 1865 the pupils of the Military School at Constantinople were similarly preserved; in the same year, at Cuidad Real in Spain the upper part of the town was cut off from communication with the lower in which cholera raged, and remained free. In 1859, in the province of

Mecklenburgh Schwerin, of forty-two instances in which the first cases were isolated, and disinfectants used, these measures were completely successful in thirty-five, and the epidemic did not develop itself. At Bologna in 1865 several cases of cholera were treated in hospital, some in private houses, all carefully isolated, with the result that only thirty-six cases of the disease occurred in that city, while in other towns in Italy the epidemic committed great ravages. In 1873 at Indianapolis a local quarantine was established about each of the infected premises, and the disease emphatically stamped out.

3. With special reference to India, it is recorded as the result of experience, that quarantine cannot be carried out with sufficient stringency over the length and breadth of the country to be successful; that it is impracticable with reference to villages from which supplies are drawn; that commerce would be deranged by the measures necessary for its observance, and that social disturbances would be among the consequences.

4. In cantonments its strict observance is stated to be "simply impossible." Further, that in no instance is there evidence that quarantine has done good. It is related that in one instance in the Punjab the people declared that they preferred the cholera to the quarantine. In 1869, it is declared to have failed entirely at the stations to which it was applied. In 1872, some stations in which no quarantine was observed escaped; at others where quarantine was applied so strictly as to interfere with commerce, it raged severely. At Roorkee quarantine was strict, yet cholera appeared for the first time in seventeen years; Umritsur escaped without quarantine. As a principle, it is declared that the difficulty of carrying out efficient isolation is no argument against taking every practicable means to prevent communication with possibly infected individuals or masses and those that are healthy. In 1875 in Bengal efficient

measures of this nature were said to be impracticable, and that such as were applied, failed to prevent the introduction of cholera. In the same year while cholera was known to be distant forty miles from Salem town, Madras Presidency, a quarantine was established in the direction from which the epidemic was considered likely to approach. The disease however suddenly appeared in the town.

XCIV. SANITARY CORDONS.

1. It is laid down as a rule that the more scattered a population of a place or district is, and the sooner isolation by means of cordons is established after the occurrence of cholera, the more effectual the measure will be.

2. Some instances are recorded in support of the efficiency of such cordons. In 1832 the town of Three Rivers on the St. Lawrence had established a cordon de santé and thus escaped. In 1834, acting upon the theory of non-contagion, this precaution was not adopted, and a devastating pestilence ensued. In 1866, the town of Tiberiad in Palestine was attacked with cholera; a cordon was established around it, with the result that the disease died out in the town and did not spread from it. Similar results are said to have occurred in some places of the Russian empire, as, for example, at Nejef and Kerbela. In Russia, in 1831, sanitary cordons were maintained; the deaths by cholera that year did not exceed 100,000, and there were only 336 towns attacked. In 1848-49, the epidemic entered the empire, notwithstanding the most strenuous and expensive measures on the frontiers against it; having entered the places attacked by it exceeded 471, the deaths were over a million, communication being open between infected localities and healthy.

3. In other parts of Russia and in the empire generally, the insufficiency of cordons has been considered de-

monstrated, and their formation abolished as useless. At St. Petersburg 20,000 serfs broke through quarantine and fled over the country, spreading the disease among the villages to which they went. In 1830 the cordon of Austrian troops towards Poland was withdrawn before the occupation of Warsaw, and restored after the epidemic had extended to that city. In 1831, in Russia, Austria, and Prussia, sanitary cordons were everywhere overstepped by the epidemic, although Governments had unlimited command of troops. The town of Debreczyn in Hungary suffered more than any other town in that country, although it was guarded by a triple cordon. In Spain cordons were abolished long ago. In 1833-34, every traveller from an infected country was subjected to the performance of strict quarantine. If he entered Spain without going through this formality, he was liable to be punished by death, his apparel burnt, his goods seized, and the same punishment extended to those who received him. Notwithstanding this, the disease entered the country and raged with great virulence in many provinces. In 1848-49 the experience of Naples, Vienna, Moscow, and other continental towns is considered to have proved the inefficiency of quarantine regulations to repel epidemic invasion. All French writers on the epidemic in France declare that it was found impossible by means of sanitary cordons to preserve a locality from attack.

4. If sanitary cordons are established too close to the foci of the epidemic, the persons forming the cordon may be attacked, and thus themselves become the means of disseminating the disease to those whom they are intended to protect.

XCV. LAZARETTOS AND ISOLATION.

1. Cholera patients may be isolated in various kinds of lazarettos, including improvised huts, tents, and separate buildings, whether on the mainland or islands, and on board ship.

2. The more isolated the lazaretto, the more efficient it is considered to be. If on shore, the minimum space deemed necessary in it per man is fixed at 10 feet \times 10, with a height of 15, equal to 100 superficial and 1,500 cubic. Means of ventilation and other sanitary requirements should be provided according to established principles.

3. Experience has shown that cholera does not spread to any great extent among persons confined in lazarettos. This circumstance is said to be accounted for by the theory that as on board ship, the survivors in an outbreak of the disease acquire a kind of immunity from it. It is observed for example, that in the Turkish lazarettos, notwithstanding their overcrowding and other unfavorable hygienic conditions, the epidemic was only slightly developed among the inmates of those establishments. In 1865 Sinope, Varna and Bourgas were protected by means of quarantine and lazarettos, the disease hardly extending beyond the latter.

4. Instances are recorded where the best results have followed upon the use of lazarettos, whether tents or huts; also, that notwithstanding the disadvantages of ships in regard to ventilation and other arrangements, similar good results have occurred. At New York, for example, the passengers arriving per *Virginus*, *Atlanta* and *England* were placed in floating lazarettos, with the result that the city escaped the epidemic.

5. But not only has experience indicated that in the majority of instances the establishment of lazarettos with a view to check the progress of cholera from the East to

Europe has been unsuccessful, but that lazarettos themselves have become sources of danger to the inhabitants of places when they have been maintained ; that in fact they have favored the propagation of the disease.

6. It is recorded that in 1864, no cholera existed in Odessa before the middle of July. Cases were then taken into the lazaretto from ships arriving from Constantinople. A month afterwards the disease is believed to have been conveyed to the city by means of a custom house agent. In 1865, when cholera appeared in Turkey and Greece, the lazarettos were overcrowded and badly constructed, hence they were more dangerous than useful.

7. There is considered to be sufficient evidence that cholera may extend from a lazaretto to the neighbouring population, without it being possible to trace personal communication between them. This is recorded to have occurred at Smyrna, Cyprus, Beyrout, Trebizond, Sulina, &c. In 1865 the first cases of cholera among the inhabitants in Malta occurred in members of a family occupying a house 660 feet from the lazaretto in which infected pilgrims from Alexandria had been placed, although no direct communication could be traced between the lazaretto and family in question. According to evidence on this subject laid before the Constantinople Commission, the extension of the disease was by some witnesses declared to be incontestible, by others, very doubtful, by others, doubtful.

8. Instances are recorded in which a patient with cholera having escaped or been conveyed from a lazaretto to a neighbouring town, has become the centre from which the disease in epidemic form has spread among the population of that town.

9. Houses of refuge in times of cholera are in some respects like lazarettos. The establishment of houses of refuge was instituted in Edinburgh and London in 1832,

for the reception of inhabitants of houses or rooms in which cholera appeared, but who were themselves unaffected. In them sanitary requirements were as far as possible observed. The London Board of Health had information of 1,691 persons taken into them, and of that number only thirty-three became affected with cholera, and only ten died. In Edinburgh, Glasgow, and Oxford, 1,010 persons were taken into such houses of refuge, of whom forty took the disease and fifteen died. The value of such establishments is dwelt upon by various writers.

XCVI. DISINFECTANTS.

1. The employment of disinfectants in regard to cholera seems to date only from 1817, although long prior to that time means of this nature were made use of in cases of dysentery, typhus fever, &c.

2. Writers have expressed themselves thus: "We must ask ourselves what have we to disinfect to prevent cholera? What is it? No one has yet been able to tell us. It is better that disinfectants should not be relied on, for having recourse to them we deceive ourselves and believe we are doing something, when in reality we are doing nothing at all."

3. International Commissions recognise the existence of several diseases, the prevalence of which in assemblies or buildings disinfectants alone fail to destroy. Among such diseases are typhus, scarlatina, puerperal fever, hospital gangrene, pyemia and cholera.

4. The Constantinople Commission however, believes that it is possible by disinfectants to extinguish primary foci of the latter disease; that to do so, they should be employed to dejecta, clothing, chambers, &c. It is further added, disinfection of cholera evacuations is known to be

an effective and necessary method of checking the dissemination of the disease. In 1854 cholera was introduced into the jail of Kaisheim. The hygienic condition of that jail at the time was very bad, but the dejecta of the cholera patients and of all other prisoners being disinfected, the disease did not spread. In India their use in this way is inculcated not only before the outbreak of cholera, but during its continuance ; also applied to apartments and buildings vacated in consequence of the epidemic. Disinfectants have been the means of eradicating infection from ships. In 1866, the ship *Helvetia* sailed from Bristol for New York with emigrants. At that time cholera prevailed in that city, and the emigrants being chiefly German, had passed through infected places. Cholera broke out on board almost immediately after they had started. The vessel was put back to Bristol, the passengers disembarked, the interior of the ship disinfected. This done, the voyage was resumed, and no further case of the disease occurred on board. See lxxiv. 10.

5. According to the same Commission, disinfection applied to cholera according to a natural method and with perseverance, is a powerful auxiliary : (1), as to the receptivity of a locality menaced by cholera ; (2), the destruction of the germ of the disease when imported into the locality ; (3), in the limitation under favorable circumstances of the extension of the epidemic. To ensure these ends however, it is necessary that disinfectants be employed on the approach of an epidemic, their use not postponed till it has appeared.

6. Some disinfectants when employed to cholera evacuations, are considered to be more effectual than others. The following are severally advocated, namely, zinc, iron, charcoal, lime, sulphur, chlorine, and carbolic acid.

7. Not only is the necessity dwelt upon of disinfecting evacuations, but also clothing used by cholera patients,

utensils, and apartments. When the disease occurs in boats or ships, these should similarly be disinfected.

8. With regard to sulphate of iron, it is recorded that in Bavaria, in 1854, wherever cholera evacuations were disinfected by sulphate of iron, the disease limited itself to its first victim. A similar result is recorded at Landschut; it is also stated that when the preparation was employed in houses as a prophylactic, and before any manifestation of cholera had occurred, no case of the disease happened. A similar result occurred in the same year at Hospital Barracks near Bristol. On the other hand, it is said to have been employed for the disinfection of cholera evacuations in 1866 at Frankfort, Halle, Leipzig, and at Pill near Bristol, without any good result.

9. Experience is declared to have proved that the employment of chlorine is effectual to only a very limited extent compared with the great results expected from it; also, that similar effectual results were not obtained from chloride of lime as from the sulphate of iron.

10. The use of the mineral acids becomes limited, in consequence of the irritation they produce in the respiratory canals. Thus, sulphur when burnt and transformed into sulphurous acid, can only be used to a limited extent. Nor is it considered certain that it destroys poison and contagion to the extent believed in by some writers. From time to time the use of this agent has been advocated: now lauded, then all but forgotten, then lauded again as if its employment were the result of new discovery.

11. Carbolic acid is considered to be specially suited to the disinfection of ships. The Constantinople Commission makes no reference to its efficiency regarding cholera onshore.

12. Permanganate of potass is considered efficient in disinfecting the air of apartments; also of disinfecting water when a few drops are added to that liquid.

13. The combustion of aromatic herbs and the use of vinegar have been recommended as disinfectants. Both have been declared to be useless.

14. Prolonged immersion in water disinfects contaminated articles, provided the water is often renewed. This may however take place at the cost of contaminating the water itself, which may in turn become dangerous. These risks chiefly apply to streams and to the water of ports in which ships having cholera on board are moored.

15. In America, instances are recorded in which epidemics have been altogether averted, or greatly modified by the timely use of disinfectants. In Jefferson City cholera had prevailed severely and fatally before 1849 and during that year. In 1867 the impending epidemic is said to have been averted by their use. In Caseyville not a case occurred after disinfectants were used.

16. Disinfectants are of two kinds, viz., destructive or conservative. The former act by oxidising and consuming whatever organic matter they come in contact with, attacking first the more advanced products of decomposition. The latter destroy effluvia and organic matter, when such matter is in small quantity, but are inert upon large masses.

17. Among mechanical disinfectants employed are the following, viz.: *a*, charcoal; *b*, unslaken lime; these are said to be more effectual when used together. Charcoal placed in apartments has been said to destroy the infection of cholera; on the other hand, cholera has been known to effect the crew of a ship laden with charcoal; *c*, fresh earth, recommended to be used in sinks; *d*, saw dust, convenient for the reason that it is easily destroyed when saturated with cholera matters; *e*, wood ashes, no better than dry earth, and besides, thrice the quantity as compared with dry earth is required for the purpose.

XCVII. HEAT AS A DISINFECTANT.

1. It is believed to be demonstrated that the infection of scarlatina and of plague in clothes is destroyed by the process of exposing them for 24 hours to a temperature of 167° F.; that of small-pox by 250° F. The virulence of cholera poison, however, was not affected in 47 per cent of cases by boiling at 212 F., and doubts have been expressed as to the measure being actually effectual in even that proportion.

2. Questions have been raised as to whether the public health may not be affected by the plan of burning rubbish, &c., in times of cholera. This question has arisen at Mecca, where the public baths are thus heated. The hakeems of India believe that cholera poison may be transmitted in the smoke from furnaces for the destruction of *refuse*, and that this measure of conservancy is on that account open to question.

3. In 1848-49 violent diarrhoea in Spitalfields and Southampton was traced to exposure of its subjects to emanations from a factory of desiccated night soil. In both instances the affection ceased when the manufactory was shut up.

XCVIII. THE QUESTION OF ENCAMPING TROOPS.

1. The object sought to be attained by removing troops from barracks into camp in times when cholera prevails is, to withdraw them from an infected locality, or to disseminate them over more extended space than that afforded in cantonments. The measure is only applicable to troops who are unaffected by the disease. Those who have become its subjects are considered likely to derive more benefit by remaining stationary than if subjected to the discomforts of a move. Another object is to remove the healthy men away from their vicinity.

2. The plan of removing troops into camp and in case of necessity changing ground from time to time is of old standing. In 1774, during an epidemic of cholera at Madras, it was successfully carried out. In the West Indies the practice has been followed, apparently from a date even beyond that. When in 1817 the disease attacked the forces under command of the Marquis of Hastings, frequent moves were considered to have been principally instrumental in freeing that army of the epidemic. In 1818 the Royals occupying old barracks at Jaulnah were attacked by the disease; they were removed into tents; the epidemic began immediately to moderate, and speedily ceased. In 1817 to 1819 it is stated in the reports of local Medical Boards, that removal to a camp was often useful during cholera epidemics, that the progress of the disease was often stayed by this means, although the sick and baggage moved into camp with the effective troops. The change from one locality to another having been found often sufficient to stop the disease, the circumstance was adduced as an argument against its being contagious. In 1825 the 31st Regiment stationed in Fort William was attacked. The men were immediately placed in tents on the glacis and the epidemic ceased. In 1826 and 1827 similar measures were taken with like success in regard to the troops at Berhampore. In 1843 the 39th Foot at Agra suffered severely from cholera. It was sent into camp at Rambagh with the result that "in about a week, the experiment was attended with complete success, and the disease disappeared." In 1848 the 1st Bengal Fusiliers being affected at Cawnpore, were moved into camp. Heavy and continuous rain succeeded; the camp was flooded; the corps returned immediately to barracks, and no further case occurred. Similarly, the 31st Regiment at Umballah became free from the epidemic. These occurrences are believed to point to the circumstance that a temporary move from infected barracks may be sufficient to induce a cessation of an epidemic of

cholera in troops. In 1851 a destructive outbreak of cholera took place in the jail of Chittagong. A camp was pitched on a site near the main road and to leeward of an infected village, yet after the removal of the prisoners to camp no further case of cholera occurred among them. In 1853 cholera attacked the prisoners in the jail at Ajmere, but the epidemic was immediately checked by the removal of the convicts from the prison. In 1856, cholera having attacked severely the prisoners in Agra jail, they were moved into tents, their camp shifted, with the result that the epidemic immediately declined. The results of experience gained during the epidemic in Northern India in 1861 are valuable in regard to this subject. A portion of the troops being moved from Mean Meer to camp at Shadera across the Ravee, the epidemic ceased in the portion so moved, at the same time that it continued to prevail among those left at Mean Meer. From this circumstance the Cholera Commission expressed a belief that had the troops been earlier moved from the infected station than they were, much of the deadly epidemic that befel them in cantonments would have been avoided. At Unrisur no case occurred among the men of the 94th Regiment after they moved into camp. At Meerut, in consequence of the flooded condition of the surrounding country, it was for some time found impracticable to move the troops into camp, yet when this measure was taken, the result in the Royal Artillery was considered satisfactory, and in the 8th Hussars no case of the disease occurred after the men were placed under canvas. At Agra, on the occurrence of the epidemic in the jail, the prisoners were moved into camp with benefit. In the case of the 42nd Highlanders, the move into camp was also successful, although the tents had to be pitched on wet ground. At Malta, in 1865, by placing the men in tents the epidemic was quickly checked, although they had to use their barracks and barrack latrines during the day. During the Indian epidemic of 1867, it is recorded that the

measure was followed by benefit in twelve instances, and in twenty others was decidedly favourable; also, that in some instances the general health benefited. In 1871, it is stated, that on the occasion of the epidemic in the 18th Hussars, the disease immediately ceased on their being removed into camp; and it is believed that had the move been delayed, the daily attacks would have greatly increased. In 1875 the conclusion arrived at in regard to the disease in India was, that removal into camp was generally attended with good results, and that in no instance did evil results arise from it.

3. Not in all instances however has benefit been obtained from moving troops into camp. In 1856, the 2nd and 3rd Troops of 2nd Brigade Horse Artillery at Mean Meer were on 7th August attacked with cholera. On the 12th, after thirty-three cases had occurred, they were sent into camp at Umur Sidhoo. Almost immediate benefit followed, and on the 15th of August the 4th Battalion, 324 strong, which had suffered severely, marched to the same ground. On the 16th and 17th there were numerous cases in the Battalion, and on the 18th the men were brought back to cantonments. On the 19th the Horse Artillery returned also, no fresh case having occurred among them during the previous forty-eight hours. The disease re-appeared among them after their return to barracks. The epidemic of 1867 also in India seems to afford many examples in point. It is recorded that in some instances no improvement took place; that in others the disease was not checked; that losses were very heavy; that on a few occasions evils took place little if at all less than cholera itself; that in some regiments the subsequent sickness was slight, in others heavy. For example, in 1861 the mortality at Mean Meer among the men of the Royal Horse Artillery was greater than among those who remained in cantonments. It is observed however that although in this instance the number of cases increas-

ed upon going into camp, the disease disappeared altogether in four days, while among the troops left in cantonments it continued far more than a fortnight afterwards. In the case of the detachment of the 51st Regiment that left the Fort of Lahore in August, although the men suffered very severely, the disease ceased five days after they went into camp. It is also to be observed, so say the Cholera Commissioners, that in some of the most successful cases the first result of the movement has apparently been a momentary increase in the number of attacks. The fatigue of the work and exposure may probably have induced to this.

4. Instances also occurred in which, without any apparent cause, benefit seemed to follow upon the removal into camp of one body of troops, not so in another at the same station, their circumstances being to all appearance identical. At Umballah in 1867 this occurred, but the probable causes of the circumstances do not appear, from published reports. At Shajehanpore in the same year the results were favourable in regard to one part of the 36th Regiment; in another portion of the same regiment the reverse. Instances are further recorded in which one portion of troops being moved into camp while another portion have remained in cantonments, decrease in the epidemic has occurred in both simultaneously. In 1869, cholera prevailed in the Royal Artillery at Cawnpore; one half of an affected Battery was moved into camp, and in it no further case occurred; after its removal however, no further case occurred in the portion that remained. Theoretically the circumstance may admit of explanation, on the ground that the activity of the epidemic influence in the particular area had ceased.

5. On some occasions it would seem that actual evil results have followed upon the removal of troops from barracks to camp during the prevalence of cholera. In 1856 malignant cholera attacked the men of the 3rd Bengal

European Regiment at Agra in the month of June, when the heat in hospital was 98° F., notwithstanding the use of tatties and thermantidotes. The first case occurred on the 10th of that month; the disease continued to rage, and on 26th June the troops marched from barracks to camp at Rambagh. This movement was attended by disastrous results. The heat in tents was intense, the admissions the same day from apoplexy and fever were so numerous that accommodation for them could with difficulty be found; sickness continued, and on the 29th they returned to barracks, but there continued to suffer from cholera and heat apoplexy. In this instance the troops had evidently not only at first been retained in the infected barracks, but returned to them too soon. In 1857 some regiments, healthy in barracks, were severely attacked by cholera on taking the field on the occasion of the outbreak of the sepoy mutiny. The 75th Regiment and Bengal Fusiliers thus suffered before Delhi. In the Madras Presidency, troops manifest a special liability to cholera, while on the line of march, and of course encamped from day to day, and thus carry the disease with them through a long journey. At Morar and Ferozepore, in 1867, the troops moved into camp lost several men from sun-stroke. At Peshawur in the same year the prevalence of fever was supposed to be due to exposure of the men under canvas. In 1869 it was considered that the portion of the 7th Fusiliers then stationed at Saugor that moved into camp, suffered severely, while those who remained in cantonments suffered considerably less.

6. Troops on the march and in camp affected by cholera have lost the disease on going into barracks. This happened in respect to the 63rd Regiment on its march from Poonah to Bellary. While en route, the corps was severely attacked, but on arriving at its destination the epidemic left it.

7. In 1827, army medical officers recorded as the result of their then experience, that the measure of moving troops

into camp was successful when done in the proper and favorable season ; but that in the hot winds encamping the men was found to be attended with no advantage, but the contrary. In recent times it has been laid down as a principle that moving assemblies are only benefited by well regulated removals from place to place, which improve their hygienic conditions, and by their withdrawal from infected localities diminish the risks of transmission of the disease among them.

8. In some instances removal of troops into camp at a short distance from their barracks is followed by the result that the epidemic ceases among them. This may occur even when the men continue the same water they made use of while in their barracks. In 1853 cholera attacked the 3rd West India Regiment at Up Park Camp Jamaica. The men were immediately encamped on the parade ground, with the result that no sooner were they removed from barracks to tents than the scourge ceased among them. In 1861 when cholera attacked the troops in the Clydesdale barracks at Allahabad, the move of the men into camp was successful, although the position of the camp was within a radius of a mile from the infected barracks, and the hot season was at its height.

9. In other instances moves in the vicinity of barracks appear to produce no good result. In 1861 the troops at Morar were moved into camp at a distance of only 500 yards from their barracks. The results were unsatisfactory ; but it is observed that constant communication took place between the men who were in camp and those who remained in barracks. At Peshawur in 1867 the results were unsatisfactory in regard to the troops removed into camp in the valley of Peshawur itself, but favorable in regard to those moved to Cherat. At Allahabad, in 1872, moves in the immediate vicinity of the cantonment are stated to have produced little or no benefit ; that in fact

they were useless. Moves along the line of railway to a distance of thirty to forty miles were in some instances successful, when no benefit occurred from those within a small radius from barracks.

10. It is considered that in order that the removal of troops from infected barracks into camp may lesson the violence and extent of the disease, it is necessary that it take place immediately on the appearance of the disease. If carried out at a later period, this result does not always follow. When such is the case, the circumstance probably admits of explanation, as shown above. The evil results of bringing troops too early back from camp to barracks in time of cholera have on several occasions received illustration in India. At Morar in 1861 this happened, and not only did a great increase occur in the proportion of cases in the troops thus brought back as compared to what they were in camp, but also as compared to what happened in that portion of the troops who had not left their barracks.

11. It is further observed, that as after a time the epidemic ceases after cholera has attacked all such as are in a condition of "receptivity," the cessation may occur altogether independent of whether troops are moved into camp or remain in barracks. The natural evolution of a cholera epidemic should not therefore be mistaken for diminution contemporary with disappearance of the disease.

12. On some occasions decrease in the number of cases has been observed to follow immediately on the removal of troops into camp. In other instances this result has only followed after a short interval, and in some there has even been an increase, lasting for a longer or shorter period, and rendering subsequent moves necessary. Such cases are explained on the theory that the troops have carried the "seeds" of the disease with them into camp. It has been observed that the ratio of deaths to cases in camp remains

much as it was in barracks, but that decrease takes place in the number of cases of the disease. In 1861 however, according to statistics given in regard to the Infantry at Morar, the percentage of deaths to cases treated was 58·4 in cases admitted in camp; 79·6 in cases admitted from barracks, and 90·9 in cases among hospital patients. In some instances recorded, a diminution in the number of cases has not followed until after the lapse of some three or four days after the troops have been encamped. In a few instances of this nature their premature return to barracks has been followed by unfortunate results.

13. During the American epidemic of 1873, discretionary power was confided to local authorities to move troops into camp or not on the appearance of cholera. This was notably the case at Lebanon, Ky. In India the regulations on the subject are very stringent. If, during the hot and rainy seasons in that country, there are many available buildings separate and away from cantonments, they should be used in preference to tents. Soldiers from different stations should not be placed in the same camp. The tents should be erected upon a good site, be often struck and re-pitched. They should be kept well ventilated. There should be good water supply in their vicinity, and easy of access. The camp ground should be free from rank vegetation, but have if possible the shelter of trees. It should be away from the villages, not on the lines of ordinary commerce, and have not been previously used for a similar purpose. The men should, whenever practicable, sleep upon cots in tents. Troops encamped on account of cholera should not return to barracks until ten days have elapsed from the occurrence of the last case of the disease.

14. Under particular circumstances, cholera among troops has ceased after removal from an infected locality even when their camp dwellings have been brought with them. This applies to encampments of wooden huts. In 1855, at

the siege of Sebastopol, a row of huts successively occupied by the 79th and 31st Regiments and Royal Artillery showed a disproportionately large number of cholera cases. The huts were pulled down, re-erected upon a higher site and re-occupied by the troops, after which only one case of the disease occurred among them, and the malady completely ceased.

XCIX. CHOLERA CAMPS IN RELATION TO POPULATION.

1. The dispersion of cholera by means of camps in an otherwise healthy locality is considered an almost certain means of propagating the disease in that locality. Danger exists also of establishing in this way a number of foci, from each of which the disease may subsequently spread. When considering the propriety of moving troops or other bodies of people into camp, it becomes necessary to give due weight to these circumstances. Such camps may also become a source of danger to persons employed in connection with them. In 1861 the 51st Regiment being sent from Meean Meer into camp, a gang of prisoners were employed to pitch the tents and dig latrines for the troops; of the prisoners so employed eight were attacked by the disease and three died. It is observed however that some of these men had attended soldiers attacked with the disease.

C. IMPORTANCE OF TREATMENT OF PREMONITORY DIARRHŒA.

1. In London, in 1849, 43,737 cases of premonitory diarrhœa were treated; and of this number fifty-eight only passed into true developed cholera. In fifteen large towns in England there were treated in the same year 130,000 cases of diarrhœa, of which only 250 passed into cholera.

2. A question has been raised as to whether many of those treated were not cases of simple diarrhœa. Perhaps they were. From calculations recorded in Glasgow however, it transpires that of persons treated within the first six hours of attack, a proportion of only 21 per cent. died ; of those first treated between the sixth and twelfth hour, 33 per cent. ; of those treated between the twelfth and twenty-fourth hour, 45 per cent. ; and of those treated later, 66 per cent. In Dumfries, early treatment of every diarrhœa case, together with the employment of strict sanitary measures, had the result that the epidemic was cut short in nine days. In Paisley by their employment it was cut short in four, in Glasgow in "a few days." In India the importance of early treatment is universally recognised, and in regiments, means of carrying it out are instituted in accordance with regulations on the subject whenever cholera occurs. Medicines for issue are given to non-commissioned officers in barracks, and on some occasions it has been narrated that 22 per cent of the troops have made use of them. See ix,

CI. SOME OF THE METHODS OF TREATMENT THAT HAVE FROM TIME TO TIME BEEN APPLIED.

1. Remedies the most diverse in nature have from time to time been used in the treatment of cholera. A few only can be enumerated. Perhaps the earliest method used was that which of late years has been called the eliminative : It dates from A. D. 360.

2. In the 16th century venesection ; ligatures to the head, limbs and loins ; acupuncture ; pepper in rice water as a drink, and applied to the testes ; purgation after the violence of the disease had gone.

3. During the 17th century the natives of India withheld liquids from cholera patients, and cauterised the soles

of their feet. Among other remedies employed were diffusible stimuli; saffron; opium; vegetable astringents; harts-horn, &c.

4. Towards the latter end of the 17th century and early part of the 18th, the French Missionaries at Trichinopoly administered to the cholera patients "un peu d'eau bénite, et se mit à réciter avec foi quelques prières," with the asserted result upon the authority of themselves, that in the cases so treated "le malade guérit subitement."

5. Among remedies employed during the 18th century, the following are enumerated; namely, calumba root in 1756; cassia fistula and rhubarb in 1761 to 1763; opium and rice water in 1769; Glauber's salts, with tartrate of antimony in doses of one-eighth of a grain in 1782; Madeira wine, laudanum and cordials, also in 1782; castor oil at Arcot in 1787; large doses of opium at Batavia in 1789.

6. During the 19th century, methods, very opposite in their characters, have been used. In 1817, large doses of calomel with opium in small doses. In 1831, emetics of ipecacuana were said to have "acted like a charm," also sulphur and phosphoric acid. Bleeding used in 1832, was less so in 1849. Naptha was employed in the Prussian Army in the Caucasus, and for a time had the reputation of being a specific. It was administered in doses of ten to twenty drops. This substance is believed to be the principal ingredient of the Russian *Elixir of Woreneje*. The naptha used was the genuine white or rose colored; not black or brown, or distilled. Napthaline and Petroleum were used in the United Kingdom in 1846 and 1848. Opium vaunted by one set of authors, condemned by others. So also with ipecacuan. Evacuants praised by some, declared by others to be deadly. Fumes of tobacco injected with similar results. Antispasmodics, notably ether and chloroform, used with advantage against spasmodic phenomena.

Frictions and excitants to the surface. Hot baths of aromatic herbs, bags of hot sand to the hands and feet, negus and grated nutmegs internally. The application of cold. Quinine. Preparations of strychnine and nux vomica. Sulphate of copper, reported on favorably by some, condemned by others. Homæopathy. Maintaining the temperature of the body. Hypodermic injections of various kinds. Inhalation of gases. Transfusion of blood and of various remedial agents. Purges. Astringents. Carminatives. Acids. Alkalis. Sulphur. Sulphuric acid to destroy vibriones. Chloroform. Chloral. Acetate of Lead. Tatrato of Antimony. Stimulants. Preparations of Iron. Hydro-sulphuret of Ammonia. Galvanism. *Sumbul*, (said to be from an undescribed umbelliferous plant) olive oil. Yeast. Eupatorium, &c.

7. With regard to these and other remedies applied, the results, as summarised in the report by the French Academy of Medicine, have been that, as a rule, 50 per cent of the patients in that country died. See xxix.

8. The Conseil de Santé des Armées, among the instructions issued by them in 1849 wrote thus: "Point d'empirisme: il est indigne du vrai savoir et de l'habilité pratique; point de dangereux essais sur les défenseurs du pays; point de coupable témérité déguisée sous le nom de hardiesse, application méthodique et consciencieuse des principes fondamentaux de l'art de guérir; à cela se réduit le devoir du médecin militaire dans tous les cas." The principles laid down in the paragraph quoted are specially recommended to Army Medical officers, now and at all times.

CII. HYGIENIC MEASURES CONNECTED WITH TREATMENT OF CHOLERA.

1. In the Report by the French Academy of Medicine, the hygienic measures considered most suitable are enumerated. In that report it is stated that the best method is to neutralise the miasm, primary source of the malady. But, as observed by the same body, the nature of that principle being unknown, the antidote has yet to be found. The principal indications to fulfil are thus enumerated. To moderate the numerous evacuations. To maintain warmth. To favor the circulation of the blood. To maintain cleanliness around the patients ; free ventilation ; disinfection of clothing and dejections, and the speedy removal of the latter. Long continuance in the rooms or wards of the sick to be avoided. The attendants to be often changed. Superfluous persons sent away. Temperance and moderation in all things inculcated. Tendency to diarrhœa checked. Infected localities abandoned. The timid immediately sent away. Diminish the number of predisposed. Public and private latrines, drains and sewers disinfected before and during an epidemic. Sources of putrid emanations removed. Special and suitable wards for cholera patients established. Bedding and linen readily changed. Cleanliness, and open ventilation maintained. If epidemic be protracted, special wards to be arranged. Air of dead houses disinfected. Dead bodies quickly interred, surrounded by lime. Water for use drawn from a pure source. Quality of meat tested. Tainted articles of food rejected. Sale of drinks supervised. House to house visits instituted. Treatment in early stages employed. Also the affected removed quickly. Dwellings cleansed. Persons arriving from infected localities isolated, and to receive all needful care. Assemblages prohibited. Troops not to march through infected districts. To be broken up and spread if attacked, encamped in a healthy spot and placed under shelter. Camp grounds to be ploughed up after occupation,

and so left fallow during a year. Ponds and pools should be filled up with fresh earth, not by debris of towns. In civil life the importance of house to house visitation is dwelt upon by writers. A similar principle is equally valuable in reference to troops in barracks. Regulations in India and elsewhere contain instructions in regard to frequent inspections of the troops in barracks, and early treatment of the men without sending them to hospital.

2. The subject of Hospital Hygiene in relation to cholera is of so great importance as to deserve special consideration in these notes. This will appear from the recorded observations during the epidemic in Northern India of 1861. Taking as examples a few hospitals, it is on record that in regard to that of the Infantry at Meerut, and the remark is more or less applicable to the others, it had become infected with cholera poison to such a degree that it was almost literally certain death to enter them whether sick or as attendants. The wards were so crowded that in an apartment capable of accommodating 60 patients, not only was that number in it, but 150 attendants in addition; the state of dirt and saturation with morbid matters within such, that the odors therefrom were most offensive, and believed to be the cause of vastly increased mortality in all who were exposed to these conditions. At Gwalior there was every reason to believe that the regimental hospitals had become dangerously infected; patients with other diseases were attacked by cholera with extreme violence, and those who were subjects of the prevailing epidemic dreaded to enter those establishments. After a time the hospitals were abandoned with good results. At Umballah 41 per cent of cases in the 89th Regiment were apparently connected with the hospital. At Delhi the first man of the Artillery attacked was the hospital serjeant; and of 25 cases that occurred, 20 per cent were considered to have had their origin in hospital, either in patients or in the hospital

guard. At Meerut, besides the sick in the 35th Regiment, a large number of men attacked were believed to have contracted the disease directly or indirectly from hospital. In regard to these and other similar instances, the question seems natural, does the continued presence in hospital of sick with the diseases than cholera tend to localise and concentrate therein the morbid influence of that scourge while epidemic? At all events, the facts related indicate the propriety of abandoning the hospitals in time of epidemic cholera, and of treating sick by that disease in tents or barrack buildings, as the case may be. The Commission dwells strongly upon the necessity, in a sanitary point of view, of having no patients laboring under other diseases in the same ward with those from cholera. It also offers the suggestion that cases of cholera in wards extemporised for the purpose should be arranged in accordance with the stage of the disease in which individual patients are that a soldier suffering in the early stage, or from a comparatively slight attack, should be in an apartment in which others in the more advanced stages, especially that of collapse, do not remain, also that the sick should be moved from room to room or tent to tent according to their condition, as slightly attacked, severely, in the advanced stages or convalescent. Experience seems also to indicate a greater rate of mortality among cholera patients when large numbers are accommodated in one ward than where they are more disseminated. See xlii.

CIII. PROPHYLACTICS? AGAINST CHOLERA.

1. How far any known means are capable of actually preventing an attack of cholera seems to be still open to question. Those ordinarily used include proper diet, free ventilation and pure water. After cholera had appeared in the United Kingdom, sulphur was for a short time stated

to have prophylactic powers. Phosphoric acid subsequently enjoyed that reputation for a short time, afterwards common salt. The use of peppers and spices with food has been recommended. During the American epidemic of 1873 *internal disinfection* was partially employed, sulphate of iron and sulphuric acid being given with this view. The sale of vegetables and fruits was interdicted. Orders were issued that cases of diarrhoea should be early treated. Quinine alone, or in combination with iron, was recommended; also early disinfection; in some instances, the increased use of salt internally. At Nashville a daily ration of quinine and whiskey was given.

2. Some writers, alluding to the comparative immunity of the Chinese from cholera, have attributed this immunity to the national habit of tea drinking. In China, hot but weak infusion of tea is the ordinary beverage of the people.

3. The prophylactic measures usually employed in India include the following, viz., prevention of overcrowding; placing men in verandahs or in tents near their barracks; preventing the ingress of natives; if new buildings are being erected at stations, accommodating the builders and other work people in tents for the purpose situated at a distance. The use of hot coffee by the men in the early morning is recommended; the avoidance of excess; the wearing of flannel belts; the avoidance of wet, and of fatigue. Commanding and other officers exert themselves to amuse and occupy the troops, and thus, as far as practicable, divert attention from the actual conditions of the time.

CIV. CAN CHOLERA BE EXTINGUISHED?

1. The disease, as observed in the present day being, according to views expressed by some authors, necessarily the result of new conditions produced in India towards

1817, the extinction of the disease is by them considered possible.

2. On the other hand it is stated that no conditions "new" in nature existed in India at the period named; that the conditions which make cholera permanent in the country are still unknown.

3. Consequently any prediction on the subject is premature; the disinfection of India can only be a remote contingency. Is there then no hope that the occurrence of cholera in that country can be lessened through the employment of Hygienic measures? On this point the views expressed by the Cholera Commission of 1861 may appropriately be here given. "Practical measures for the prevention of cholera can only be founded on the observation and recognition of the facts which the disease ordinarily presents. If this principle be kept constantly in view, and mere theory be carefully avoided, we believe that very much may be accomplished. We do not overstate our opinion when we say that measures may be adopted which will render such mortality among our soldiers as that which occurred during the late epidemic at Meean Meer and Gwalior hardly possible for the future." So may it be.

DEDUCTIONS.

From the facts and views recorded in the preceding pages, the chief deductions which present themselves are enumerated as follows; their arrangement being in accordance with that of chapters forming the body of the present work, viz. :—

- I. *a.* Cholera may occur in sporadic, endemic, or epidemic form.
- b.* Different attacks and epidemics vary in severity.
- c.* One attack gives no immunity from others of the disease.
- II. *a.* Sporadic cases may occur independent of, or precede an epidemic. They may be themselves the only manifestations of an epidemic.
- b.* It is not possible to distinguish between a case of sporadic and one of epidemic cholera.
- III. *a.* Cholera is believed by some writers to have originated in the valley of the Ganges.
- b.* And to be endemic elsewhere.
- c.* If endemic, the causes of its being so have to be discovered.
- d.* But facts are adduced against the theory of original endemicity in the valley of the Ganges.
- IV. *a.* An epidemic may or may not confine itself to an endemic area.
- b.* The actual exciting cause of an epidemic is unexplained by any existing theory.
- c.* Epidemics may prevail at points distant from each other without any traceable communication between them.

- V. *a.* Whether an epidemic, which in its after-course extends over a great extent of the world has always its origin in an endemic area, is a point yet to be ascertained.
- VI. *a.* Cholera has shown itself to have periods of increase, and others of decrease.
b. Some writers believe the present time to be the commencement of a period of decline ; others doubt the existence of such a cycle.
- VII. *a.* In many instances recurring epidemics have been traced to renewed importation.
b. In India epidemics of cholera are believed to recur at intervals of four and five years.
c. If recrudescence of the cholera principle occurs at all, the conditions under which it does so have to be ascertained.
- VIII. *a.* In many instances the attacks and progress of cholera are to all appearance capricious.
b. In many more they are accounted for by individual and local conditions.
c. So also with some other zymotic diseases.
d. But all are regulated by their special laws.
- IX. *a.* Diarrhoea may occur independent of, or in connection with cholera.
b. Although often preceding the latter, cholera sometimes attacks without preliminary diarrhoea.
c. Cases of choleraic diarrhoea may convey pure cholera.
- X. *a.* On occasions during the prevalence of cholera as an epidemic, the general

populace have been affected with various degrees of derangement in their state of health.

- XI. a. Cholera may spread from particular centres or foci.
- XII. a. It manifests a partiality for localities.
- XIII. a. Instances are recorded by writers tending to indicate that its prevalence is affected by geological formations.
b. But the existence of any such connection doubted by others.
- XIV. a. Neither does it appear to be affected by conditions of physical geography.
- XV. a. The theory is expressed that connection exists between the occurrence of cholera, and the nature and condition of particular soils.
b. In practice, cholera seems to cling to the soil of some places.
c. But the theory as expressed in reference to Munich is unsupported by occurrences in India.
- XVI. a. Cholera manifests a partiality for river deltas; to the banks of some; and is conveyed by means of traffic along their course.
- XVII. a. The sea, although itself a barrier, often favors the spread of cholera by means of traffic and communication.
- XVIII. a. It is asserted that deserts prove an effectual barrier against cholera.
b. But certain occurrences tend to cast doubt upon the absolute truth of this.
- XIX. a. Cholera has of late years appeared at elevations to which formerly records make no mention of its having attained.

- b.* Instances are mentioned, more especially in Persia, of the disease not extending beyond certain elevations.
 - c.* Epidemics are said to rage with peculiar violence in districts that skirt the base of mountain ranges.
- XX. *a.* Residence on hills in India, particularly in the case of troops, is said to increase their after-liability to cholera.
- XXI. *a.* A connection has been supposed by some writers to exist between cholera and certain other epidemic diseases.
 - b.* It has been asked, do they prevail alternately or together in particular areas.
- XXII. *a.* An analogy is believed to exist between the phenomena of cholera and those of malarial fevers.
 - b.* On occasions, outbreaks of these diseases have appeared to have a certain connection with each other.
- XXXIII. *a.* Several points of similarity have been recorded in regard to the spread of small-pox and of cholera.
- XXIV. *a.* Although in some respects similar, yet certain differences exist between malaria, and the producing influence of cholera.
- XXV. *a.* Diffusion of cholera may be limited in extent, or extend over a great part of the earth's surface.
 - b.* Although often traceable to human communication, instances are numerous in which no such means of propagation can be found to exist.
 - c.* Diffusion of the epidemic takes place irregularly.
 - d.* It cannot be checked by any known means.

- XXVI. *a.* Cholera radiates in all directions in its progress.
- XXVII. *a.* But when imported into a new locality, does not always spread therein.
b. Unfortunately there is nothing to indicate before-hand the instances in which this happens.
- XXVIII. *a.* The rate of mortality to population, and to cases varies in different epidemics.
b. Also, it would appear, according to season.
c. And in different races of people.
- XXIX. *a.* Although a decrease seems in late years to have occurred in the ratio of cases of cholera to population, an increase is believed to have taken place in that of deaths to cases.
- XXX. *a.* For the most part, it is believed that we are ignorant of the actual nature of the cholera germ, or poison.
- XXXI. *a.* Certain circumstances seem to favor the assumption that cholera may be spontaneously developed, and spread as an epidemic.
b. But there are others adverse to this theory.
- XXXII. *a.* Under particular circumstances, the duration of activity of the choleraic influence may be considerably prolonged.
- XXXIII. *a.* The period of incubation of cholera may vary from a few hours to three weeks.
- XXXIV. *a.* The duration of an epidemic may vary from a few days to several months.
- XXXV. *a.* In individuals, the duration of attack may vary from a very few hours to some days.
- XXXVI. *a.* In India the development of an epidemic may occur spontaneously.

- b. It is believed that in all other countries such development only occurs after importation has taken place.
 - c. It may appear simultaneously at a number of places distant from and without known communication with each other.
- XXXVII. a. A belief exists that in the majority of instances the attack by the disease takes place in early morning.
- b. It occurs at all hours.
- XXXVIII. a. The fœtus in utero has been found dead by cholera, and a man 108 years old is recorded as having died by the disease.
- b. Youth and old age are believed to be the periods when persons are most subject to it.
- XXXIX. a. Cholera has been known to attack one sex, and to leave persons of the other sex in the same establishment exempt.
- b. Varieties seem to exist in their relative liability.
- XL. a. Although in some instances persons of temperate habits have been considered less liable to attack by cholera than those of intemperate, there are others on record in which the converse seems to have taken place.
- XLI. a. The debilitated usually suffer to a greater extent than the robust, although not so on all occasions of cholera epidemics.
- XLII. a. Persons sick in hospital are peculiarly liable to attack by the disease.
- XLIII. a. Cholera is for the most part fatal in cases of puerperal women.

- XLIV. *a.* In some instances, persons have become panic-stricken on the occurrence of cholera.
- XLV. *a.* Fugitives from infected places have been the means of introducing the disease into those to which they have fled.
- XLVI. *a.* Cholera may affect in different degrees and ways, natives and foreigners.
- XLVII. *a.* In many instances, new arrivals in an infected locality suffer more than those longer resident. In some, the converse of this happens
- XLVIII. *a.* Different classes of native communities are differently affected by cholera.
- XLIX. *a.* A similar circumstance holds good with foreigners in an infected area.
 - L. *a.* Prisoners in jails are variously affected by cholera as compared to other classes of persons.
 - LI. *a.* The question, does cholera become acclimatized out of India requires further observation.
 - LII. *a.* There seems reason to believe that liability to cholera is modified according to consanguinity.
 - LIII. *a.* Various degrees of exemption to attack have been recorded to exist among individuals.
 - LIV. *a.* Certain places appear to be exempt from cholera.
 - LV. *a.* Certain occupations are believed to confer immunity.
 - LVI. *a.* Statistics are recorded in regard to the number of cases during epidemics occurring in particular houses.
 - LVII. *a.* Upper and lower storeys are believed to be affected in different degrees.

- LVIII.** *a.* There are many circumstances on record that support the belief in transmissibility of cholera by man.
- b.* Also that indicate the absence of transmissibility in special instances. Thus, persons have left infected localities for uninfected, yet cholera has not been thus conveyed to the latter.
- b.* Instances of transmissibility being well established, safety lies in adopting measures according to this knowledge.
- LIX.** *a.* Although many cases are recorded of the disease to all appearance being propagated by contagion, instances are adduced of close contact not being followed by its occurrence.
- b.* As it is impossible beforehand to say with precision whether the disease may be so propagated to individuals or not, the safest course is to act as if it were capable of being so.
- LX.** *a.* Experiments of inoculation have been performed with cholera matters.
- LXI.** *a.* The result of observations seems to be that attendants upon sick by cholera suffer to a greater extent by the disease than other persons.
- b.* Many remarkable exceptions however are recorded.
- LXII.** *a.* Vehicles for, and receptacles of cholera poison are various.
- LXIII.** *a.* The distance to which cholera is conveyed by means of air is believed to be limited.

- b.* Contaminated air pre-disposes to attack, as pure air conduces to recovery and prevention.
- LXIV. *a.* A moist and stagnant condition of the atmosphere is considered to favor the occurrence of cholera.
- b.* In regard to other atmospheric conditions, no definite connection has been traced between them and the occurrence of the disease.
- LXV. *a.* No actual connection has been proved to exist between organisms found in the atmosphere and cholera.
- LXVI. *a.* In some places a connection has been believed to exist between the occurrence of cholera, and the prevalence of particular winds.
- b.* It has also been considered to be conveyed by prevailing, and checked by opposing winds.
 - c.* According to other accounts the direction of the prevailing wind seemed to have no relation to the disease.
 - d.* It has even advanced in its progress directly against the prevailing wind.
- LXVII. *a.* The occurrence of a storm has frequently in times of cholera been followed by a cessation of the epidemic.
- b.* In other instances a storm has heralded the occurrence of an outbreak.
 - c.* But often cholera is unattended by any atmospherical preturbation.
- LXVIII. *a.* Cholera does not appear to be excluded by any temperature or season. As a rule

however, the progress of the disease is greater in the hot period of the year than in the cold.

- LXIX** *a.* In many instances the connection appears direct between contaminated water and cholera.
- b.* In others no such connection is traceable.
- c.* By some writers contaminated water is looked upon more as a predisposing, than active cause of the disease.
- LXX.** *a.* Certain kinds of food and fruit are believed to induce attacks of cholera.
- b.* Articles in themselves wholesome may become contaminated, and thus convey the disease.
- LXXI.** *a.* Although some epidemics have been preceded by famines, others have not.
- LXXII.** *a.* The extension of cholera is to a great extent effected by means of ships.
- LXXIII.** *a.* Cholera is at times transported by means of river and canal boats.
- LXXIV.** *a.* The phenomena adduced in favor of the theory of pandemic waves may be otherwise explained.
- LXXV.** *a.* The disease is considered transmissible by means of articles of clothing and bedding.
- LXXVI.** *a.* Also, by certain articles of merchandise.
- LXXVII.** *a.* A doubt exists in regard to transmissibility by means of living animals.
- b.* They are looked upon however as a possible means of transmission of the disease.
- LXXVIII.** *a.* Dead bodies of persons, victims of cholera, are believed capable of transmitting the disease.

- b.* But this property is probably limited to a particular stage of decomposition.
- LXXXIX. *a.* Dejecta of cholera persons are perhaps of all means of propagation, the most dangerous.
 - b.* The period of danger from this source is limited to the stage of decomposition.
 - c.* In a dry state the poison contained in them may retain its vitality for a long period of time.
- LXXX. *a.* Assemblages of people are among the surest means of propagating cholera.
 - b.* Yet the disease does not of necessity occur in all such assemblies even in India,
- LXXXI. *a.* Cholera in many instances extends along lines of communication.
 - b.* But there are instances of the extension of epidemics where the circumstance cannot thus be explained,
- LXXXII. *a.* The epidemic, although it does not travel with the rapidity of railway communication, is undoubtedly conveyed from place to place by means of railway traffic.
- LXXXIII. *a.* Pilgrims in India and elsewhere are a powerful cause of cholera outbreaks, and extension of epidemic.
 - b.* Yet instances occur of the disease occurring among pilgrims and not spreading beyond them.
- LXXXIV. *a.* Troops on the march in India are very liable to attack by cholera, more so apparently in the Madras Presidency than in either of the others.
 - b.* In India and elsewhere, troops have been the means of spreading the disease among civil populations.

LXXXV. a. Various manifestations in regard to different orders of animals have been observed in, or connected with cholera epidemics.

b. There seems reason to believe that some animals may become affected by cholera, and transmit the disease to other animals of the same kind.

LXXXVI. a. Blights in the vegetable kingdom have also observed before or during a cholera epidemic.

LXXXVII. a. It is asserted that the progress of cholera may be staid by a belt of trees, also that the disease is less severe in wooded districts than in those of an opposite description.

LXXXVIII. a. A belief is expressed that by surrounding localities with fires, cholera may be prevented or extinguished. So far the results appear to be negative.

LXXXIX. a. The better the hygienic conditions of a community or locality, the less risks of attack by cholera. This rule holds good, although instances are recorded of the disease attacking those in good hygienic conditions to the exemption of those in bad.

XC. a. As the presence of filth favors the occurrence of cholera, so does cleanliness avert it. Individual exceptions occur, but such is the rule.

XCI. a. The question has been asked, do quarantine measures cause less or more injury to the general well-being of a people than cholera itself?

- b. To be effectual, they must be complete. Some such instances are narrated, but under certain conditions this completeness seems impossible to attain.
- XCII. a. Measures of quarantine are more easily applied in regard to sea than land.
- XCIII. a. Although instances are recorded of the successful application of quarantine measures by land, they have often been powerless for their object, and in India, their effectual application is considered to be impracticable.
- XCIV. a. Some instances are given of the efficiency of sanitary cordons. In others their insufficiency is said to have been demonstrated, and in some countries they have been abolished as useless.
- XCV. a. Although in some instances the best results have followed the isolation of people in lazarettos, these establishments have in others become themselves foci from which the disease has spread.
- XCVI. a. Different views have been expressed in regard to the efficiency of disinfectants in cholera. Some of such preparations seem to be more useful than others.
- XCVII. a. Heat, although for the most part effectual as a disinfectant, does not seem to be equally so in cholera as in regard to some other diseases.
 - b. There is reason to believe that danger exists from the fumes arising from the process of burning contaminated refuse.

- XCVIII. *a.* The plan of removing troops into camp from an infected locality has been long practised with benefit. In some instances the expected benefit has not arisen, in others positive harm has been occasioned. As a sanitary measure however it is for the most part beneficial.
- XCIX. *a.* Cholera camps may themselves become sources of danger to the locality in which they are situated.
- C. *a.* The importance of treatment in the stage of premonitory diarrhoea is universally allowed.
- CI. *a.* Almost every kind of treatment has been used. The result has been much the same in regard to all.
- CII. *a.* The employment of hygienic measures at the same time that medical treatment is applied, is dwelt upon by writers.
- b.* Questions of hospital Hygiene are of especial importance during the prevalence of cholera epidemics.
- CIII. *a.* It is open to question how far prophylactic measures that have heretofore been used against cholera have been completely successful.
- b.* The comparative exemption of the Chinese has by some writers been connected with the circumstance that tea is their universal beverage.
- CIV. *a.* Unfortunately there is no apparent reason to believe in the early extinction of cholera in India.

APPENDIX A.

*Résumé of the Report on Epidemics of Cholera in France** in 1832, 1849, 1855 and 1865.

THE Academy of Medicine having appointed a committee of its members to investigate cholera, a number of reports were submitted to that committee on the epidemics which at various times have visited the country. From them an able report was drawn up by M. Barth; but for our present purpose it will be sufficient to notice only some of the conclusions at which an endeavour has been made to arrive—for it must be confessed that few, if any, have actually been reached.

France has been visited by four great epidemics of cholera, besides some partial explosions, which seem to have been appendices to them. Thus, there were, (1) the epidemic of 1832, followed by a short re-appearance, in 1834, on the shores of the Mediterranean; (2) that of 1849; (3) that of 1854, which began in November, 1853, finished in January, but recurred in March following, and did not disappear till 1855; and (4) that of 1865, which broke out in June, continued throughout that year and the following, not disappearing till 1867.

With regard to direction, those of 1832, 1849, and 1854 invaded the north of France, advanced westward, ending in the Department farthest in that direction. That of 1865, on the contrary, appeared on the French shores of the Mediterranean, extended northwards, and reached the remote parts of Brittany and Normandy. The epidemic of 1832 broke out in Paris with great violence in the latter days of March, ravaged several districts

* *Rapport sur les Epidemics du Cholera Morbus qui ont régné en France pendant les années 1854 et 1855.* Par M. Barth, au nom d'une Commission, &c. &c. Paris: P. Masson, Editeur, 17, Place de l'Ecole de Médecine, 1874.

Translated and condensed by C. A. Gordon. Published in the British and Foreign Medical Chir. Review, 1874.

like a hurricane, attacked in succession 56 departments, ending the same year, after destroying 110,000 to 120,000 persons. That of 1849 also appeared in the end of March. It for a time was restricted to the parts immediately around Paris. It then attacked the city with a violence hardly less than that of 1832; ravaged 57 departments, and disappeared before the end of the year, having caused 100,000 to 110,000 deaths. The epidemic of 1854, on the contrary, began at the end of October 1853, appeared to diminish soon afterwards, rekindled in March, having Paris for its principal theatre. Thence it extended over 70 departments, and ended the following year, after having destroyed more than 140,000 victims. That of 1865 appeared in June, prevailed for some time at Marseilles and Toulon; some months afterwards it appeared in Paris, where it lighted up in the following summer, causing at the same time cruel ravages in Amiens. It continued throughout the winter in the north-east of France, and was not extinguished till the end of 1867, having visited fewer departments and caused much less mortality than either of the preceding epidemics. Thus, while the epidemic of 1854 had a shorter period of duration, and caused more victims than either of the two preceding invasions, that of 1865, slower in the progress of its movement, continued longer, yet caused less mortality than either of the others.

In the two first epidemics the northern part of France principally suffered. Of 56 departments invaded in 1832, 52 only were so also in 1849. In 1854 the epidemic had a greater extent; it produced great mortality in Paris, and stretched thence to the Alps and the shores of the Mediterranean. Of 70 departments invaded by it, 54 had been previously ravaged by one or two epidemics, and of 16 respected in 1854, six had been previously visited by the disease. At the end of that year only nine departments had remained unvisited during the several epidemics. Of these, one was slightly visited in 1855; the eight others preserved their immunity during the invasion of 1865-66. Thus, certain regions were visited by all the epidemics; others were visited by one or more, while a few have continued exempt from all. As a rule, the districts most spared were those in the centre of France, and most elevated above sea level; on the

contrary, those most densely inhabited and of inconsiderable elevation, suffered most. In this, however, there is nothing either absolute or constant. Thus, in 1854, the epidemic was in sixteen departments more fatal than in that of the Seine. Amiens, previously spared, suffered greatly in 1866; Rouen was exempted in 1854, and Lyons was only slightly visited by any of the epidemics. For a time explanation of this relative immunity was believed to exist in conditions connected with the nature of the soil. The exemption of the regions in the north-east, in 1832 and 1839, was attributed to the existence of sandstone of the Vosges; yet that region was mostly dealt with in 1854. In a similar manner, parts of an arrondissement or canton spared at one time, have been ravaged at another; while others, ravaged by the early epidemics, were exempted by subsequent ones, although they continued to rage around them.

In some places, the epidemics of 1854 and 1865 were more distinctly preceded by derangement of the intestines than those of 1849 and 1832. Such derangement was by one set of observers looked upon as premonitory of the epidemic; by others, as independent of it, and only caused by ordinary causes incidental to the heat of summer; by some as due to fear of the epidemic. In many localities, however, the epidemic suddenly appeared while the state of the public health had till then remained satisfactory.

In all, the epidemics the disease showed itself in the forms of cholérine and confirmed cholera. The affection becoming developed in a person arriving in a healthy district from one infected, seemed to have a period of incubation, varying in length from one to four days. Whether in the form of cholérine or cholera, the attack for the most part occurred at night; this circumstance being variously attributed to the process of digestion after a heavy meal, to the body being at rest, and to the non-renewal of fresh air around the person. Sometimes the attack was sudden and severe, death taking place in a few hours; more frequently it was slower, being preceded during some hours or days by diarrhœa,—an indication of great importance when it does occur, as treatment employed in this stage often checks

the further development of the disease, and consequent mortality by it. Diarrhoea is so constant a symptom, that its absence, recorded by some authors in cases of what they called *dry cholera*, is denied by the majority, or looked upon as an error of diagnosis. For the most part it is the principal indication of the disease, and that which first appears ; being followed in their turn by vomiting, cramps, cyanosis, failing of the pulse, coldness of the extremities, alteration of the voice, and suppression of urine. All these indications characterise the several epidemics, presenting only some slight modifications here and there, as less abundant dejections, less violence of cramps, less cyanosis, and so on. In the epidemic of 1854, the dejections contained more lumbrici than in any of the others, these entozoa besides being thus evacuated appearing sometimes in the matters vomited. The appearance of characteristic complications seemed less sudden in the epidemics of 1854 and 1865, in some places, than in those preceding ; in others they were more so, and the progress of the disease to death in many more rapid. In some marshy districts the disease presented some characters of intermittence more or less marked. In some instances, in all epidemics, the disease did not advance beyond the state of cholérine, convalescence more or less rapid taking place from it. In other instances diarrhoea, nausea or vomiting, cramps, and the other characteristic symptoms, were present in inconsiderable severity (*cholera léger*) ; but more frequently there were repeated evacuations of serous fluid, succeeded by violent and painful cramps, great coldness, alteration of expression, voice sunken, and pulse imperceptible (*cholera grave*), but between these extremes there were intermediate cases, having neither the moderation of the first group nor the intensity of the second (*cholera moyen*). For the most part death took place in the algide stage ; often, however, where treatment was early employed, reaction was obtained, characterised by diminution of the evacuations, cessation of vomiting, appeasement of cramps, re-establishment of the pulse, and return of warmth. This reaction, when excessive, gave place to congestions of the encephalon and lungs, followed by prostration and stupor, designated a typhoid state. In these respects the epidemics of 1854 and 1866 presented similar

characters to the two preceding, with merely slight modifications. In the two latter, papular and erythematous eruptions, diptherite and swelling of the parotids, were more frequent than in the former, and further, a diminution in the numbers of attacks and deaths by ordinary diseases was observed during the two last epidemics. In 1854 an exception to this occurred in regard to the prevalence of *sudamina*, or sweating sickness. It continued on that occasion to affect one set of patients, while cholera attacked another, the two diseases appearing to run their course independent of each other. In some instances, however, they succeeded each other in the same individuals; the occurrence of *suetie* at times seeming as preparatory of cholera, in others, seeming to act as a preservative against it. In all the epidemics, relapses and the occurrence of sequelæ of the disease were observed. In some instances, persons who had been affected in one or both the epidemics of 1832 and 1849, escaped in 1854; others were attacked in each of the epidemics which occurred, and some who had recovered on the two earlier occasions being carried off in 1854.

The duration of the disease in the several epidemics was very various. As a rule, it was of shortest duration in the early period of an epidemic, the patients often dying in eight to ten hours. In the most part, however, they succumbed in thirty-six hours to two days in the algide stage, or at a later period their reaction and the typhoid state set in. Excepting slight cases, recovery did not take place completely in less time than a few days. In the greater number of instances, especially if attended by reaction, it did not take place in less than two weeks; often convalescence was slow, being accompanied by persistent debility. Frequently the occurrence of cholera causes the death of the fœtus in uteri, and induces abortion. In a few cases abdominal dropsy has disappeared, after an attack of the disease. In all the epidemics, it was observed that cadaveric rigidity set in early. In some exceptional cases certain movements of contraction and extension in the limbs occurred after death. The anatomical changes did not vary during the various epidemics. The isolated follicles of the intestine were exaggerated; the heart and vessels contained ropy black blood; there was

more or less injection of the mucus membrane of the digestive tube, suffusion of the lungs; vascularity of the pia mater and mucous centres in cases of death after reaction. These are the appearances found in all seasons, and in all latitudes.

On the subject of etiology, it is observed that cholera has visited regions the most diverse,—continents and islands,—all latitudes, from the equator to the polar circle,—climate the most diverse, and elevations above snow level. With regard to France, it has prevailed in all seasons, temperatures, and barometric conditions,—in dry weather and in wet,—under electric conditions the most diverse, and in all conditions of the wind. From the reports received, however, it is clear that a high temperature is favourable to the development and increase of the disease it being during the hot season that the attacks are most numerous, and in the cold that they are less so. According to reports of 1854, great and violent atmospheric perturbations, as hurricanes and sudden variations of temperature, are often followed by an increase in the number of attacks and deaths by cholera. The wind seems to exert an influence as an agent of propagation of cholera at a short distance, and places fully exposed have been found more severely affected by the epidemics than others that were more sheltered. In France the disease prevailed throughout the four arrondissements, at altitudes the most diverse, including the mountains of the Vosges, Jura, Alps and Pyrenees, and on the plains that border the Mediterranean. It has prevailed in districts of different geological formations, including primitive, secondary, and recent; on the sides of hills, and in valleys, plateaux, and plains; bare and wooded districts; waste and cultivated; upon dry soils and upon humid; sandy, gravelly and clayey; chalky and marshy; quartz, sandstone, and granite; in districts the most healthy, and in those that are unhealthy. As a general rule, however, it is observed that low situated localities, and those that are marshy, are especially favourable to the development and spread the disease, and that such as are elevated and naturally healthy, afford comparatively the greatest security.

As no kind of locality remained free from the disease, so no class of persons were exempt. All social grades and positions

suffered from it. In some places, even where the hygienic and social conditions seemed most favourable, the rich and well-to-do suffered the most severely; nevertheless, the result of careful analysis has been to show that cholera has prevailed most where the hygienic conditions have been bad;—that want of air, crowding, insufficient clothing or warmth, fatigue, bad food and privation, all conduce to it; also, that depressing moral influences have the same effect. In addition to these, the development of the epidemic is favoured by the occurrence of inundations during the hot weather, contamination of the water, vitiation of the air by telluric and foetid emanations of various kinds, great agglomerations of people, and in fact, all violations of hygienic laws. Several reports specially indicate the liability to attack of such as are employed in attendance upon the infected, as also of those who have to deal with and wash the linen used by them, and with the interment of the dead. No age was exempt from attack; yet the two extremes of age and youth furnished the largest proportion of deaths. The weak and enfeebled offered least resistance to attack; yet the strong and robust were in no way exempt from it. Those suffering from chronic diarrhoea, from phthisis, and such as were convalescent, seemed also to be peculiarly exposed to it. There appeared moreover to exist an individual predisposition to attack; and it is remarked, in regard to the epidemic of 1854, that this predisposition was traced in numbers by consanguinity of the same family, rather than among such as were only related by marriage.

Various opinions have been expressed in regard to the nature of the disease. It has been considered to consist of a species of intermittent fever, an affection of the ganglionic system, a variety of typhus, a disease of the liver, a special fermentation, a new disease *sui generis*, the cause being according to some unknown, according to others, existing in conditions which induce sporadic cases of cholera, and these becoming more general and intense affect the masses in the form of an epidemic. Others look upon it as consisting of a miasmatic poisoning, of an unknown nature, affecting the nervous system, of organic life, or the blood, and entering the system by the pulmonary or digestive canals. This uncertainty in regard to the nature of

cholera is reflected in the different opinions expressed as to its propagation. According to some authors, the disease springs up, is developed and multiplied, in a given locality under the influence of various morbid causes, becoming fatal by their accidental co-existence. Others add to the presence of insanitary conditions, the concurrence of accidental causes, such as modification of the air by the existence of diseases of the vegetable kingdom, and general debility arising from deterioration of alimentary substances. Some consider that it is imported by persons arriving from an infected locality, that the disease becomes multiplied and developed, and communicable from one to another by *mediate* contagion, in the same way that typhus does. This theory, generally denied in 1832, was more frequently brought forward in 1847, and in 1854 became predominant; sixty-one out of ninety-seven authors who allude to it expressing their opinion that cholera is thus transmitted.

In 1865 the opinions in favour of the importation and mediate contagion of cholera became still more general. It had appeared at Mecca immediately after the arrival at the place of a caravan of pilgrims from India; it increased in an atmosphere rendered pestiferous by the presence of thousands of putrefying dead bodies; it broke out at Cairo and Alexandria with the return to those places of the pilgrims; it invaded afterwards Constantinople, then Malta, Barcelona, and Marseilles,—these being the ports between which and Alexandria communication was most frequent; and while it extended in other directions, Sicily, at which no vessel touched, escaped. At the same time, attention being awakened, it was easy to follow the track of successive explosions, and to trace with certainty the transmission of the disease from one individual to another.

Methods of treatment the most various were employed. Bleeding used in 1832, was less frequently had recourse to in 1849. In 1854 it was used against complications, as secondary fever; but in 1865 was too much forgotten from the tendency there is to pass from one extremity to another. Opium, vaunted by one set of authors, was uncondemned by another, so also with

ipecacuanha. Evacuants, praised by some, were declared by others to be deadly. Antispasmodics, notably ether and chloroform, were generally employed with advantage against spasmodic phenomena. Frictions and excitants to the surface were used, but opinions in regard to them seem to be unrecorded, and a similar remark holds good in regard to the employment of cold. Quinine, generally without success in the algide stage, was a little more efficacious during secondary fever. Sulphate of strychnine and nux vomica were either followed by want of success or by distinctly unfavourable results, and the same is said of valerianate of zinc. Sulphate of copper, reported on favorably in one placé, was condemned in others. Without enumerating many other remedies, homœopathy was employed in many places. At Dienville, of sixteen cases thus treated, fourteen died; and at Marseilles, in 1854, out of twenty-six similarly treated, twenty-one died. It is added that where success followed remedies it was mainly due to the hygienic care, particularly to the means taken to keep up the temperature of the body. Some writers disbelieve in the power of medicine during the algide stage, observing that the function of absorption is then destroyed. Indeed, whatever methods were adopted in the epidemics of 1854 and 1865, the results were equally unfortunate as in the two preceding, namely, 50 per cent of the patients died.

When the rate of mortality is only one-third of those attacked, the results must be considered satisfactory, and when under that, as exceptional. In fact, statistics showing a smaller death-rate open to mistrust. The manner of preparing statistics varies also; some writers include all cases, whether severe or slight, even simple diarrhœa, thus showing very favorable results, although actual success is the reverse. Different degrees of strength in patients themselves also influence the rates of mortality. As a rule, an epidemic is more severe at its commencement, and less so in its decline; more fatal in infancy and old age; less so in youth and mid age; more limited in civil life, where patients are isolated; more fatal in hospitals, where it attacks organisms already debilitated, and where cases of the most severe nature are taken.

According to the majority of writers, the principal cause of mortality is the too frequent neglect of the early symptoms, and delay in employing treatment. Nearly all insist upon the necessity to combat the disease at its origin. A great many writers place *preventive* treatment, even before the curative, and only see safety in the application of hygiene to preserve persons and localities threatened by the disease. These measures consist, for the individual, of temperance, and care to avoid fatigue and excess of all kinds; for the inhabitants, cleanliness, renewal of air and ventilation, disinfection of threatened houses, and especially of such as have been attacked; the removal of dejections, the disinfection of matters and linen soiled by excretions, and the prompt interment of the dead. The wards of hospitals ought to be fumigated, and chlorides sprinkled in public places. Some reports suggest the disinfection of the atmosphere, either by fires of oil or by means of blasting powder, and in confirmation state that in the village of Thienant the epidemic suddenly disappeared after the occurrence of a fire, which consumed several houses. House-to-house visits, for the purpose of early discovering persons attacked is recommended. The committee observes, with regard to these measures, that although all are very proper, yet, would it not be better to strangle the evil at its primary source, or, at any rate, to prevent it from reaching the country?

Here arise the questions, What is cholera? Whence comes it? What is its origin? How is it developed? Cholera, such as in former times prevailed in France, is a new disease in Europe, and *sui generis*; nor does the history of epidemics afford an exact description of the disease as it has been seen there. Notwithstanding the identity of the name with epidemic cholera, the sporadic is essentially different from that disease, both in its nature and in its great severity. The one is deadly, the other benign; the relative severity of the two being compared to the sting of the Indian scorpion and that of Europe. The sporadic form—the product of causes easily appreciable, as for example, cold drinks during the hot season—is altogether of an individual character, and by no person believed capable of being communicated by the subject of attack to another. The epidemic form is often developed without the presence of sufficient appreciable

cause, affecting a large number of persons and places, under hygienic conditions the most diverse, and often transmitted from one individual to many others.

1. It is universally admitted that India is the home of the disease, especially the districts near the large rivers, as plague prevails in the delta of the Nile, and yellow fever at the mouths of the Mississippi. According to one set of pathologists, cholera is the product of a special miasma originating in India, transported into Europe across continents and seas by atmospheric currents; according to others, cholera is produced on the spot where it shows itself, engendered by accidental local conditions, such as are called epidemicity, and multiplying by the action of special causes on the mass of the population; a third class consider that cholera, originating in India under particular conditions of climate, propagates itself to long distances, transported by man, and multiplying by successive transmission, favoured by accidental causes. In opposition to the first theory various objections of great weight are adduced. The exhalations from the Pontine marshes do not produce fevers at a great distance from their source. Let us therefore admit for cholera effluvia a power even a hundred times greater, it would be insufficient to account for its transport to a distance of four or five thousand leagues from its point of origin. Is it admitted that the miasmas become multiplied in the atmosphere? How are we to understand that effluvia, arising in India in 1817, and carried by the atmosphere, required fifteen years to traverse the 2,500 leagues which separate the banks of the Ganges and those of the Seine? What slowness, when hurricanes traverse the breadth of France in one day! How does it happen that these miasmas propagate themselves in different directions?—that from the Bay of Bengal they extend eastward to Sumatra, Borneo, and China; southward to Ceylon, Malabar, and Mauritius; northward to Tartary; north-west to Persia and Egypt, and thence across Russia and Europe? How are we to explain the circumstance that, in 1832, cholera passed from Germany to London without affecting Belgium; passing also from London to Paris while strong north-east winds prevailed, and with a clear sky? Is it said in reply, that in the higher

strata of the atmosphere, there are currents which proceed in an inverse direction to those that are apparent? The supposition is gratuitous. According to the committee, the epidemic was carried by English travellers fleeing from their foggy country already infected, to enjoy the advantages of Paris, until that time free from the disease. How also are we to explain that never, in any country, has the extension of cholera coincided in a definite manner with the direction of the prevailing winds? How are we, according to the theory of transport by the atmosphere, to account for the singular tendency of the disease towards certain great cities in different epidemics? Thus, in 1832, Calais was first invaded, then Paris. In 1849, Douai, and immediately afterwards Paris. In 1853, the departments of Aisne and Paris within a few days. In 1865, Marseilles and Toulon, then Paris—always Paris. What is the situation of Paris in regard to all currents of wind from east, north, north-east, and south? Is it not rather that there is always a stream of the population itself towards the great social centre of France? It has been stated that cholera has often appeared to extend along the course of streams and rivers, and it has been supposed that this arises from the contamination of the air from the beds of those streams and rivers. But experience teaches that cholera as often ascends along the course of a river as descends by it. Moreover, is this to be explained by the circumstances that habitations are generally most thickly placed along the vicinity of rivers? If the epidemic were conveyed by the atmosphere, it might be supposed that the influence would descend suddenly upon a number of places in the interior of a country like a shower of hail. Instead of doing so, it invariably enters from the borders, most frequently from a sea-port. How again, supposing that it was conducted in the form of a miasmatic cloud, is it to be supposed that that cloud would remain during three months extended over a city, as for example in the case of Amiens? How, on the same hypothesis, are we to account for the epidemic being limited to one district, one street, or even one range of buildings?

2. Against the theory according to which cholera is generated upon the spot where it appears, various objections are adduced. The precise causes and conditions under which under such circum-

stances the disease is produced, are left undefined. Are its causes looked for in special conditions of the atmosphere of the locality? The conditions during the prevalence of an epidemic are precisely similar to what they are in its absence. Is it high temperature? In 1846 and 1863 the heat was 36° and 39° cent. (97° Fahr. and 102° Fahr.); yet no case of cholera occurred. If a high temperature favours the development of cholera, it cannot be looked upon as its cause. In the last epidemic at Cherbourg, the greatest intensity of the disease occurred in the months of January and February, 1866; and during 1830-31 it prevailed at Moscow in the winter season. Is humidity or dryness the cause? Dryness was extreme in 1846, humidity in 1852, yet cholera did not prevail in either year. Is it variations in the state of atmospheric electricity? If so, what are they different from such as take place many times without the appearance of cholera? Nothing positive on this point has been ascertained. Are the causes to be found in a changed condition of the constituent principles of the air, a diminution of ozone? Decrease of ozone occurs every summer, and the supposed changes in the constituent principles of the air have never been detected by analysis. Do the causes exist in the constitution of the soil? If so, the soil of France has undergone no change during the last thirty-five years—has been subject to no cataclysm. Have we not also seen cholera prevail in regions having the most various geological constitution?—low, damp or marshy alluvial localities near marshes, or infected streams favour the development of cholera, but are not sufficient always to produce it. Thus in some places, localities seemingly the most unhealthy have been respected, while others, to all appearance most healthy, have been ravaged by it; in the same department, arrondissement, or canton, certain villages ravaged in 1854 had escaped in 1849, and nine which had been free in 1849 and 1832, suffered severely in the later epidemics. Such conditions are very secondary. They may, and do have an influence upon the multiplication of cases of the disease; but none of these conditions, nor the union of several, have ever given rise to the disease. Do we invoke a combination of hygienic conditions, such as want of sufficient space, clothing, air, light or food, bad water, excesses of all kinds

mental depression, overcrowding, and so on? All these favour the development and multiplication of the disease, but no one or combination of them can produce the disease. To go no further back than 1792, have there existed no bad conditions since then? Had we not at the beginning of this century, throughout Europe, grand movements of armies, engagements, and battles, notably in 1813 and 1814; great military disasters, precipitate retreats, with their fatigues and privations, endured by coalesced Europe, great dryness, great humidity, scarcity, famine, typhus, and other evils?—yet in the midst of all these no cases of cholera occurred.

3. As to the theory that cholera, originating in India, was imported and propagated by man, its partisans present the disease as following the great lines of communication by land and by sea. In the first great invasion, for example, they trace it from India, where it is said to have sprung up in 1817, advancing across the continent of Asia by the route of caravans and armies, traversing in succession Prussia, Russia, the north of Germany, and reaching France in 1832. In the latest invasion, on the contrary, it was observed quitting India in the early months of 1865, advancing towards Europe by sea, and reaching Marseilles in June, that is less than six months from the time of its starting. On the first occasion it took fifteen years to reach France. In the latter it advanced with the rapidity of vessels, requiring only a few months to arrive from Calcutta and Bombay at Mecca, then at Cairo, Alexandria, the shores of the Bosphorus, Catalonia, and Provence. There exists no example, say the advocates of this theory, of the arrival of cholera from one continent to another more rapidly than the progress of travellers, and from one continent across sea more rapid than the rate of steam-vessels.

When the invasion takes place by land, it is indifferent by what point of the frontier the cholera penetrates. What it arrives from beyond sea, as from Alexandria in 1865, it first arrives in the commercial ports, as happened then in respect to Constantinople, Ancona, Barcelona, and Marseilles, all of which were affected before other places nearer the point of departure. The explosion of the disease also took place on all occasions soon after

the arrival of a vessel from the infected country. The partisans of importation, moreover, argue, in regard to the preservation of certain islands and certain establishments, both public and private, which had for a time interrupted all communication with reported localities, or prevented the approach of all vessels arriving from suspected places. Thus, Sicily was preserved in 1865 by receiving no vessel arriving from affected localities ; so also Batna, in Algeria, by means of posts of surveillance, which isolated it in the middle of the country ravaged by the epidemic.

In support of the transmutability of cholera from one person to another, the advocates of the theory adduce many instances, where the arrival of one or several persons affected with cholera in a district until then free from the epidemic, was immediately followed by a development of the disease among those who had received or attended them ; on the other hand, the opponents of that theory only see in these events the occurrence of simple coincidences, or explain them by the intervention of epidemicity, which really means *nothing*. Others adduce numerous opposing facts against the theory, giving, as proofs of the non-contagion of cholera, the cases of many persons that had attended patients, slept in their beds, and yet did not take the disease. To this the partisans of transmutability reply that in the instances alluded to, negative facts cannot destroy the value of those of a positive kind, as where the transmission of the disease had the character of evidence. At the same time the non-contagionists, while denying the facts brought forward by their adversaries, claim for those adduced by themselves in refutation, the character of being also positive. The partisans of the theory of transmissibility, however, do not assert that cholera is always thus communicated. They admit the necessity of special conditions, without which the transmission does not take place, any more than does small-pox, scarlatina, diphtheria, and so on, conditions which, as in the case of typhoid fever, depend partly upon the intensity of the morbid principle, its condensation in a limited locality, the duration of its action, &c., partly upon the powers of physical and moral resistance possessed by the individuals exposed to contagion, and their degree of susceptibility.

The partisans of epidemicity deny, as a gratuitous supposition, this condition of special aptitude deemed by their adversaries so essential for the transmission of the disease; but are they not themselves obliged to admit the existence of a partial predisposition in those attacked by the disease, and also an individual peculiarity in those who resist? How otherwise are we to account for the epidemic influence hovering over a locality only attacking some individuals, and not all? The contagionists believe that the hundreds of instances in which communication has not been traced do not invalidate a single fact of true transmissibility; thus, it is observed in the report, the cases of three medical men, whom they name, as having contracted fatal attacks of diphtheria from patients, prove the communicability of the disease, although many others who attend patients suffering from it altogether escape. One of the arguments long used against the communicability of cholera is the large number of medical men who in the first epidemic pronounced against it. This has, however, been abandoned in subsequent epidemics, and shown to have no value. Even in 1832 there were some who believed in contagion of the disease; they became more numerous in 1849, became predominant in number in 1854, and after 1865 there remained only a few opponents in the field. To refute the communicability of cholera, an argument is drawn from the small number of "sisters," students, and infirmiers, who became attacked with the disease. It may be said, in reply, that if the number of medical men and sisters is less considerable, this is to be explained by the moral power, and consequent resistance of these, to their sentiment of duty, and to their habit of struggling with disease; others refer this relative exemption to the solidity of their faith and their Christian resignation. It is asserted, on the other hand, that this pretended exemption is only an error. In 1849, at the Salpêtrière, the director, two internes, several attendants and infirmiers, succumbed, while a number of the medical men and employés were severely attacked. In 1865, eleven medical men died of the disease at Ancona, three at Paris in 1866, three medical men and thirty sisters at Amiens in the same year.

It still remains to explain the occurrence of many cases where persons have been struck at the same time and at places distant from each other, without having had any communication with other subjects of the disease, when there could have been no transmission by contact. According to the partisans of transmissibility, if cholera requires immediate contact with the patient suffering from it to be thus caused, it is communicable to a greater or less distance, according to circumstances, by the emanations from patients.

Notwithstanding the four epidemics of the disease that have ravaged Europe, a number of persons still hesitate to express their opinion on the origin and prevention of the disease. The theory of propagation of the disease by atmospheric currents suggests nothing against its course, to avert or destroy it. That of spontaneous generation of cholera, in like manner, proposes nothing, nor does it indicate where is the source of the disease, what is the cause of its production, or under what combination of conditions it is produced. On the contrary, the theory of importation of the germ of cholera, of its generation in persons successively attacked, and of its transmissibility from one organism to another, not only points to the most rational therapeutic indications, but also indicates the hygienic means best calculated to diminish the severity of the disease, and to formulate the international measures by which new invasions may be prevented. The committee, having weighed all the evidence adduced by reporters, and judging from the experience of its members, adopt the opinion of transmissibility of cholera as the most natural. They observe the frequent occurrence of the disease in the proximity of places already attacked, and the rapid development of the disease in its subjects. They look upon the enormous dejections, often amounting to eight and ten litres in the space of a few hours, as only to be accounted for as arising from the serosity of the blood exuding through the surface of the intestines, but the albumen of which does not reveal itself by the ordinary reagents. They consider that the action of *ferments*, which attack by predilection the albuminous matters, is to transform and multiply themselves; that their corpuscles, soluble or insoluble in water, become suspended in the air, and are transported by that vehicle; that cholera

originating in India is the product of a special miasm that has never been, and never can be, produced in France. This miasm, they consider, consists of subtle, impalpable corpuscles, probably organic in nature, but which have not yet been isolated by means of science. They penetrate into the living economy by the pulmonary and digestive organs, act as ferments, and produce in the albumen of the blood a modification of composition, the result of which is that the serum transudes by the surface of the intestine, thus causing decrease in the mass of the blood, the course of which in the capillaries becomes more and more slow. This morbid miasm becomes multiplied in the organism like molecules of ferments, is disengaged from the affected body chiefly by the alvine dejections, is suspended in the air, propagates itself to distances to affect new victims under particular conditions of temperature, which affect the powers and organic predisposition, or otherwise favour its effects. The primary source of the disease-producing agent resides in the patients, notably in the matters evacuated by them, not only during life, but after death. The emanations arising from the dejections become a direct and manifest cause of cholera in the vicinity of a patient, the more so when ventilation and cleanliness are neglected.

A second source resides in the dejections thrown upon refuse heaps in streets or courts, as in villages, farms, and badly-kept houses, deposited in public or private latrines, communicating by means of pipes in different storeys. The emanations thus arising from different points mixed with air, and transported with it, become the means of propagation of the disease in different directions, according to the displacement of contaminated air and the intensity of morbid effluvia.

A third source, less apparent, proceeds from water, contaminated by morbid dejections thrown upon public ways or into drains, disengaged by subsequent rains, producing streams, or percolating into the earth. Thus also, cholera is induced by water from some wells, and that from cemeteries, passing into sources of supply for towns and villages.

A fourth source of the disease exists in body linen, bedding, clothing, and other articles impregnated with the dejections of

patients. These, being sent to a greater or smaller distance for washing, become the means of transplanting the morbid principle into places until then exempt, the dissemination taking place with more or less rapidity, according to the rapidity of transport.

Lastly, patients being moved, whether individually or in masses, as emigrants, armies, or caravans, bring with them cholera into previously healthy places, even to considerable distances, and also more or less rapidly, according to the rapidity of their movements and facility of transport.

In these various ways cholera may be caused and propagated. The conditions necessary for both may exist in the chamber of the patient or in the ward of an hospital, in the vicinity of a focus formed by a depôt of alvine matters, whether removed to a distance from the affected or in their neighbourhood, or of those fleeing from infected localities, while the germs are as yet undeveloped in them, or have only produced cholérine. The circumstance that the disease on some occasions continues for a long period, affecting a large number of persons, while in others it is speedily extinguished, after making a few victims, depends upon the organic aptitude of individuals, such as we in fact have in consanguinity. It also depends upon the hygienic state of the inhabitants in regard to competency, temperance, cleanliness, distance from each other, or crowding of habitations, camps, or ships; according to the state of the locality where the germ is deposited—as to whether it is low, marshy, surrounded by hills preventing free circulation of air, and so on. Thus we have an explanation of the disease being communicated to persons residing near patients suffering from it, of its extension in the same building, in a particular range of houses to leeward of a contaminated drain, whether in a village or town. A similar explanation may be given of the sudden occurrence of the disease at great distances without intermediaries, also in places considerably separated from those where it has first broken out, contact being thus traced in many outbreaks in appearance spontaneous. In this way we can explain the good results of removal of a body of troops from a contaminated locality, or a camp the ground of

which is contaminated by putrid matters or dejections of cholera patients, and establishing them in a new and more elevated locality, the soil of which is still untainted.

With regard to treatment of those attacked by the disease, the best method is to neutralise the miasm, primary source of the malady. But the nature of that principle being unknown, the antidote has yet to be found. If science does not yet possess a special agent, it at least leads by way of induction to the employment of other agents, the utility of which has been demonstrated by experience. The principal indications to fulfil are, to moderate the enormous evacuations of fluid which take place; to maintain warmth of the surface, to favour the circulation of the blood. The hygienic measures to be adopted include the greatest cleanliness around the patients; free ventilation; the disinfection of clothing and dejections, and the speedy removal of the latter. Long continuance in the rooms or wards of the sick is to be avoided; the attendants should be often changed, and all superfluous persons sent away. As individual preventive measures, temperance and moderation in all things are to be observed; the state of the bowels must be attended to, and tendency to diarrhoea checked. Infected localities are to be abandoned when possible, and at any rate the departure of the timed will diminish the number of the predisposed, and thus lessen that of the victims. In respect to public hygiene, both before and after the outbreak of the disease, the public and private latrines, the drains and sewers, should be disinfected; all causes of putrid emanations should be removed. Special wards for cholera patients should be established in hospitals, they being provided with free ventilation and ready means to change the bedding and linen as required.

These wards should be maintained in the highest degree of cleanliness. If the epidemic be protracted, they should be changed from time to time, completely fumigated and whitewashed. The air of dead-houses should be purified as far as possible; the bodies of the dead should be speedily interred and surrounded by lime, or, as recommended in France, subjected to cremation. Water for use is only to be drawn from wells secured from pernicious underground infiltration, or from rivers above the point

of discharge of drains and sewers into them. The quality of articles of food should be tested; tainted meat and unripe fruits should be condemned; and the sale of drinks supervised.

House to house visits should be instituted, patients in the early stage of attack searched for, and treated or removed as the case may be. The dwellings should be cleansed. Paupers and tramps arriving from contaminated localities should be isolated in places set apart for the purpose, they receiving all needful care. Assemblages of troops, fairs, and markets are to be prohibited; troops should not march through infected places; they should be broken up and spread if already attacked, encamped in a healthy spot, and placed under shelter.

With regard to these measures, the Committee observes that they are all excellent in their several ways; yet that more remains still to be done: other measures must be taken with a view to prevent new invasions of the disease. Of these, the best would unquestionably be, to check the development of the disease at its original source, and adopt the same sanitary measures as made the plague disappear from the delta of the Nile. If that be impossible, the arrival of the disease must be prevented by measures the efficacy of which has been proved by experience. Quarantine should be applied to caravans leaving India towards the north-east of Europe, also to ships from India or other infected places. It is known that in 1865 the Mussulman pilgrims embarked at Jeddah carried cholera with them; they disembarked at Suez, proceeded thence to Alexandria by rail, and it was only after a new embarkation that they reached Beyrout, Smyrna, and Constantinople. With a view to prevent a similar occurrence for the future, it would be well to prevent the arrival by ships of pilgrims from Arabia into Europe.

APPENDIX B.

*Notes on Asiatic Cholera, from American Journals.**

Historical Notices.—There is good reason for believing that cholera had its origin in the Black-death or Oriental plague of the 14th century. This plague first broke out in China between 1337 and 1347, spread westward along the lines of communication, destroyed one-fourth of the population of the Old World, and one-half of that of England. From 1347 to 1373 the form of the disease assumed a milder character, and was then called the Oriental plague. No climate or season was a barrier to it, although the fatality of attacks was not so severe in cold as in hot regions. The next appearance of this plague took place in London in 1666. The mortality then equalled one-fourth of the population, whereas in the cholera of 1832 it only amounted to one in 250 of the inhabitants. In 1629, however, a description of the cholera morbus was published in Batavia, and during the 17th century that disease would appear to have confined its ravages to the Hindoos. In the first campaigns of the British troops in India, in 1774, cholera presenting all the symptoms known to characterise the epidemic, made its appearance at Madras, and proved very fatal to both the European and native soldiers. The disease prevailed at various times between the years 1783 and 1790, and always with the same symptoms and with the same fatal results. In the former year it broke out at Hurdwar, but did not extend beyond that place, and ceased on the dispersion of the multitude assembled there for bathing. In 1817, it broke out again on the banks of the Ganges. In 1818 its ravages embraced nearly all of Hindostan, and in 1819 it appeared in Java, in the Isles of France and Bourbon, and over India and China. In 1821 in Bagdad, Arabia, and in 1822 in Persia and Syria. In 1823 it broke out in Antioch, Tripoli, and all along the Mediterranean. In 1823 and 1827 it continued to ravage China. In 1828, Russia; 1830 in the Georgian cities and Poland; 1831, Russia, Prussia, Austria, Italy, and the United Kingdom. In 1832 in Paris in

* H. A. Buck, M.D., *St. Louis Med. and Surg. Journal.*

May; and for the first time in the New World, at Montreal and Quebec in June of that year. In St. Louis it has appeared three different times, viz., 1833, 1849, and 1866. In the latter year it was confined to the more crowded and insanitary parts of the town, and its rate of mortality is contrasted unfavourably with that in towns such as New York and Baltimore, where considerable sums of money were spent upon sanitary improvements. In 1833 it broke out in the West Indies; in 1834 in New York, and in the two following years spread over America. Gradually it disappeared, nor did it return till 1848, when, as on previous occasions, it was imported from Sunderland.* In April, 1849, it reappeared in the public stores at the Quarantine station, Staten Island, and in the succeeding month in the city of New York. From New Orleans in the South, and New York in the North, the cholera spread over the continent, and was even more destructive than during its first invasion. Another pause ensued, which was not broken until the spring of 1854. As before, the starting-point of the epidemic was in Asia. It ravaged the south of Europe, destroying an incredible number of victims. Cholera patients arrived at New York in the month of May, 1854, from Europe, and the epidemic straightway commenced. It prevailed during about three months. Once more (December, 1864) the pestilence went abroad. The immediate occasion of its dissemination appears to have been a great Mohammedan festival which was held at Mecca in the spring of that year. In 1867 it again prevailed in America, starting on this occasion from two separate points, namely, New York and New Orleans.

Origin of the Disease.—The first outbreak of cholera was preceded by great floods, and as the water subsided, the flooded districts were drained, foul vapours arose everywhere, from decomposing vegetable and animal matter, made more horrible and poisonous by the odour of putrified corpses, the victims of floods, famines, and earthquakes.

It is probable that the atmosphere thus contaminated gave origin to the Black-death, whenever the organs of respiration came in contact with it. At a later period it was stated that its origin in several instances was traced to the pilgrims, who visit-

* A. Stille, M. D., *Philadelphia Medical News*.

ed the banks of the Ganges. Still later, the havoc committed by the epidemic at Alexandria suggested official inquiries, and the President of the Board of Health stated as the opinion not only of the President himself, but of all the scientific and professional authorities in Egypt, that the poison is generated by crowds of pilgrims periodically visiting the holy places of Arabia. The pilgrims congregate at certain periods of the year, from all parts of the Mahomedan world, to the number of seven or eight hundred thousand.

It is a point of religion with them that no pilgrim should change his clothes during the whole time of his pilgrimage. Under these conditions they are huddled together in enormous crowds beneath the fiery sky of the desert. It is an indispensable incident of the ritual that each pilgrim should sacrifice at least one sheep, and the skin and offal of these countless victims are left to decompose under an Arabian sun. The result of all this is that thousands of pilgrims perish on the spot, leaving their bodies to be shuffled hastily under a coating of sand which the first sirocco will disperse, and their clothes to be packed up and carried off as relics to be distributed among their relations and countrymen.

Epidemic cholera is believed to depend upon a *specific principle* pervading the atmosphere; and acting in combination with a miasm from the earth it gives rise to a positive poison. Although it produces but one disease, there are different stages of it, these being in some, more or less merged into each other. The poison may act indirectly through the nervous system, or through the lungs. It is not known as yet, however, how it enters the system, nor what the precise nature of the poison is.

Spontaneous Origin of Cholera.—In a very interesting account of cholera epidemics in South America,* Dr. E. M. Estrazulas sums up as follows :—

“ 1st. Cholera was unknown in Paraguay and La Plata previous to 1866.

* *American Journal of the Medical Sciences.*

" 2nd. Before the armies were stationed at Estero Bellaco, one case had occurred, and after the removal of the troops the disease totally disappeared.

" 3rd. No vessels from infected ports arrived at La Plata or Paraguay previous to 1866.

" 4th. If cholera had been imported from abroad, the cities at La Plata ought to have been the first attacked.

" 5th. Troops coming from Brazil could not have brought the disease with them, as it did not exist at any Brazilian port or city at the time.

" 6th. Cholera appeared first in Paraguay, and following the course of the rivers infected in its downward march all the cities on their banks.

" 7th. The disappearance of the successive epidemics followed an inverse route to that of the invasion.

" 8th. The Paraguayan army, where the disease first appeared, was secluded from the rest of the world and completely blockaded by land and water.

" 9th. The disease remained epidemic for three years in Paraguay.

" 10th. The combination of causes at Estero Bellaco resembled those presented in India.

" 11th. The combination of causes in India has never been re-produced except in Paraguay."

Communicability of Cholera.—In 1832 the cases of cholera in Edinburgh were in the proportion of *one* to every *twelve hundred* of the population of the city; while among those in attendance *on the sick* the proportion was *one in five*. In 1848-9, *one-fourth* of the nurses employed in the cholera hospital took the disease, while in the general hospital, "only a few paces distant," where no cholera patients were received, not a single attendant was attacked.

It has been again and again observed, that persons employed to wash the body and bed-linen of cholera patients have suffered in a much larger proportion than other persons of the same

social condition, engaged in different occupations. The introduction of the disease by a single ship among a previously healthy population is a fact which has been repeatedly observed. Thus it was that cholera entered Constantinople in 1865. A ship having cholera on board reached that port the first week in July, 1865; thence the disease passed into the hospital, where thirty fatal cases soon occurred; and from the hospital it passed into the city, where it soon became epidemic.

But the disease is communicated by contagion, less evidently indeed, but none the less certainly, whenever the discharges from cholera patients contaminate water which is used by healthy persons for drinking. This has happened again and again.

The history of cholera shows that it advances from point to point, wherever the *men or things* infected with it are carried, as by caravans, pilgrims, armies, or individuals. It may therefore be assumed that cholera is contagious.

Periodicity of the Epidemic.—If, as is asserted by some authors, the returning cycle of cholera epidemics is a period of sixteen or seventeen years, the return of the disease to America need not be looked for until 1882 or 1883. And “not then if there is a strict observance of sanitary laws and hygiene.” Unfortunately, however, there are those who doubt this cycle, and among them some who “have little more faith in the sixteen or seventeen year periodicity of cholera than we have of ‘the forty year flood of the Mississippi.’”*

* By C. A. Gordon, Originally published in the *Medical Press Circular*.

APPENDIX C.

Resumé of Orders in regard to Cholera among Troops.

A.—CHOLERA ON THE MARCH.

1. Prior to the march of troops, it should be ascertained whether cholera prevails on the road.

2. Particular attention must, at all times, be given to the selection of encamping grounds, for which, whenever practicable, elevated and dry situations should be chosen, sufficiently removed from the village or town, and from the influence of swamps or pools of stagnant water. The banks of rivers are to be avoided. Officers are strictly enjoined never, under any circumstances, to encamp upon ground, however inviting it may appear, where cholera has shown itself in a preceding corps or detachment.

3. Officers commanding corps or detachments in movement, are to consult with the officer in medical charge, regarding the healthiness of the site upon which they propose encamping, and in such cases, officers are to be guided by medical opinion, unless they shall see weighty reasons for setting it aside, which are at once to be reported to the Quarter Master General for the information of the Commander-in-Chief.

4. In the event of the troops, or followers, being attacked by sickness, it is directed that the greatest attention be paid to the selection of encamping ground; that it be high, dry and clean; and this, it is considered, may generally be found at some slight sacrifice of convenience, with respect to water and supplies, which, however, in the case supposed, must be looked upon as of minor importance.

5. Officers whose camps may be attacked by cholera, are strictly enjoined to avoid encamping near towns or villages; and to allow no further communication with the inhabitants that may be absolutely necessary for the supply of provisions; and this under such restrictions, as may confine it to the healthiest part of the camp.

6. The same rules are to be followed when passing through a district, or through a town or village, in which the disease may exist.

7. In cases where the violence of the disease may render the measure necessary, officers will halt altogether on any eligible spot within reach, or merely move their camp for change of air, and clean the encamping ground, until it may appear advisable to move on. Whenever practicable, the corps or detachment should be broken up into as many divisions as can be properly provided with medical aid, and separate encampments formed one or two miles apart—measures being taken to prevent communication.

8. So long as cholera exists in camp, a daily report of cases and deaths is to be forwarded to the Quarter Master General; British and Native are to be separately shown, and the names of all British officers attacked or deceased, are to be reported.

9. In cases of extraordinary sickness, officers commanding corps and detachments, are authorized to indent upon Collectors, or the Commissariat Department, for such number of country cots as may be absolutely necessary.

10. When sufficient medical aid is available, and there is no military necessity for marching entire, regiments will march by wings, at an interval of ten days.

11. On every occasion of halt, orders should be issued and enforced for a thorough washing of all the clothes and for the complete purification of the carts used by the troops or their families, and the matting which forms the hood of the carts. Officers commanding are especially enjoined to see that these instructions are rigidly carried out, as it has been proved by experience that this is one of the most effectual modes of preventing cholera or of mitigating its attacks. In the progress report, it should be noted that this has been done. Care should be taken that the water used for the purpose of cleansing is not that used for drinking. A guard should be invariably placed over the latter to prevent its contamination.

12. Should cholera attack the regiment, it is desirable that a divergence from the road of four or five miles should be made

at right angles to the prevalent wind or track of the disease. But this will seldom be practicable on account of the want of supplies on a road on which notice has not been given.

B.—CHOLERA IN CANTONMENTS.

1. Immediate information by telegraph if possible is to be given by Civil and Military officers to the adjacent Military stations, whenever cholera occurs among them, in order that marching and travelling may be put a stop to, and that other stations may be put on their guard against the approach of the epidemic.

2. Whenever cholera occurs in a cantonment, preparations should be made to move any part of the troops into the selected camps at the shortest notice. If the disease threatens to manifest itself in any unusual degree or epidemic form, the body affected should be immediately moved into camp, and no unfavorable condition of the weather is to prevent this movement being carried out. The chief Military and Medical officers on the spot are to consult as to the course to be taken, and the result should be communicated by telegraph to Head Quarters. If necessary, two or three camps should be formed and additional medical aid called for.

3. The sick labouring under other diseases than cholera, will move with the force and share the benefit of removal from the choleraic atmosphere.

4. It must be insisted on, that all discharges from the stomach and bowels of cholera patients be instantly removed and buried in pits.

5. Strong deodorants are to be thrown into the receiving vessels, as well as into the pits, latrines, and privies.

6. Should cholera follow the troops, they will be removed short distances at right angles if possible, to the prevalent wind and track of the disease, every second or third day, care being taken that the marches in no way fatigue the men.

7. The breaking out of cholera in a regiment or at a station is, on no account, to cause the suspension of the soldier's daily amusements and occupations, care being taken that the latter in

no way fatigue them; and Commanding officers will use their utmost exertions to develop any recreation or employment of which the effect is to keep the men's minds in their normal state.

8. It often occurs that soldiers, on a visitation of cholera, indulge in the use of spirituous liquors, in the belief that they are a preventive against the disease. The majority of medical authorities condemn this supposed remedy as a certain promoter of the disease: Commanding officers are therefore enjoined to use their utmost endeavours to prevent so baneful a practice.

9. One of the several cholera antidotes is the early treatment of premonitory symptoms, of which looseness of the bowels is a principal one. Commanding officers are therefore requested to give the most precise orders on the subject, and to cause all men affected by premonitory symptoms to be placed at once in a premonitory ward.

10. The troops are not to return to cantonments until all traces of the cholera have disappeared from the neighbourhood, either amongst the Foreign Native population. The barracks and hospitals will be thoroughly fumigated, the walls white-washed, and the doors and window-frames painted, before they are re-occupied.

11. The men will be supplied with hot tea and coffee before going out in the morning; they will invariably wear flannel belts, and all precautions must be taken to prevent their remaining in wet or damp clothes.

12. So long as cholera exists in cantonments or in the adjacent cholera camps among the troops, a daily report of cases and deaths is to be forwarded to the Quarter Master General. British and Native troops are to be separately shown, and the names of all British officers, attacked or deceased, are to be reported.

C.—CONSERVANCY OF CAMPS.

1. With a view to preserving the conservancy of camps and encamping grounds, the Commander-in-Chief directs that the same system should be adopted in camp as is the practice in all Military cantonments, the main principle of which is, the daily burial of all refuse matter.

2. It is to be at once established as a standing order among all British troops moving in course of relief, or otherwise, that two trenches, each 2 feet deep, 2 feet wide, and 50 feet long, are to be dug by coolies to be employed for the purpose at a distance of 120 yards from the flanks of each encamping ground, the inward flanks of such trenches to be 120 yards from the outward flanks of the camp, that is in *echelon*. Should the nature of the ground prevent their location according to this rule, the same principle for their location is to be observed, that is, they are not on any account to be directly in front or rear of the camp, but in *echelon* on their flanks, being so placed that the prevailing wind may not carry the effluvia to the camp. These trenches are never to be in such proximity to wells as to render percolation to the water possible.

3. The Quarter-Master, or whoever is entrusted with the formation of the encampment, is to see that this arrangement is made daily at the advance ground before the arrival of the troops, and a flag or other mark should be placed to show the position of the trenches, one of which is to be allotted for the white soldiers, and the other for the native camp followers, &c., of a British regiment. The same *principle* is to be strictly enforced for native regiments, cavalry or infantry, on the march. Officers commanding are to allot a certain site or position in the vicinity (but not too close) of each encamping ground for the use of the native soldiery and camp followers. The present practice of defiling the ground *on all sides* of the camp must be strictly prohibited.

4. These trenches are to be thoroughly filled in with earth by coolies before the rear guard quits the ground. For those duties the coolies should be properly divided between the advance and main camps; the officer on duty with the rear guard is to be required to report to the Commanding officer that the trenches have been so filled in, and in the case of native troops, that the "sites" specially selected have been properly cleaned.

5. The Commanding officer of every regiment or detachment on the march is required to place himself in direct commu-

nication with the tahsildar, or other responsible native functionary at each encamping ground, to arrange that effectual measures are adopted by the native local authorities for thoroughly sweeping and cleaning the whole area of each encamping ground immediately it is cleared of the camp, as well as the "sites" above referred to, and for burning or removing to a suitable distance all collections of stable litter or refuse of every kind, &c., so as to make the ground perfectly fit for re-occupation by any troops marching by the same route.

6. In the event of troops forming a standing camp for exercise or other duties, or halting more than the ordinary time at any camp ground, an additional deep trench should be dug at a distance of at least 200 yards from the camp, and to leeward of it, on the same conditions as the first trenches, for the reception of filth twice every day, coolies removing it from the camp trenches before mentioned, and depositing it in the deeper and distant trench, as is done from the latrines, in cantonments, and covering over with earth each day's accumulation.

7. Enquiries are to be made by the Quarter-Master, or other responsible officer of the regiment, at each advance ground, from the same native functionaries, as to whether the well water has been recently drawn, and the well in a state fit for use for drinking and other purposes. If not in a wholesome state, effectual arrangements *must* be made for rendering it so *before* the arrival of the troops on the encamping ground.

8. In the Progress Reports furnished by regiments to the Quarter-Master General of the Army, a note is in future to be entered that these orders have been strictly carried out.

9. The coolies to be employed are to be supplied by the native local authorities on the requisition of the Commanding officer in such numbers as may be actually required. Payment will be made on contingent bills vouched in the usual manner, and forwarded to the Quarter-Master General to be disposed of as are all other contingent expenses on a march.

10. The requisition for the coolies should be made by the Commanding officer at the same time that he furnishes the civil authorities with the indent for supplies.

1. In the event of difficulty being found in supplying coolies, a working party from the Regiment must be told off to dig the trenches and fill them with earth, but not to remove the excreta.

12. Regimental intrenching tools are to be used.

D.—FAMILIES ON THE MARCH.

1. The following arrangements are ordered with reference to the movement of the families of troops, British and Native.

2. Officers commanding regiments are allowed the discretion of sending the families in advance of the men in the afternoon, or of suffering them to follow the regiment, but the former course is to be preferred when it can be adopted without inconvenience.

3. If the road is good and obstruction of rivers, &c., does not occur, the families may generally arrive soon after the regiment on the ground. When it is otherwise, it is better that the families should precede the men. But in either case, the regimental artificers and a strong working party from the regiment under a Non-Commissioned officer, should accompany the carts to assist them in case of need.

4. The Quarter-Master of the Regiment will mark out on the new ground a site for the families to leeward of the ground chosen for the camp of the men, and at some distance from it. Crowding of the bandies should be prohibited, and the bullocks should be removed to the rear. No carts ought to be allowed to leave the camp during the night, as they create disturbance and obstruct the road for the regiment in the morning.

5. The Officer commanding will take particular care that unripe fruit and other unwholesome articles are not sold in the camp, nor brought to it. Frequent inspection of the bazaars should be ordered.

6. In order to maintain men and families in health, they should be encouraged to eat heartily, and to bring to speedy notice any attacks of diarrhoea or any premonitory symptoms of cholera, however slight.

The above resumé comprises the purport of a General Order by His Excellency the Commander-in-Chief of the Madras Army, dated 22nd January 1866. A few verbal changes have been made from the original, but the purport remains unaffected thereby.

APPENDIX D.

SUGGESTIONS REGARDING MEASURES AGAINST CHOLERA AMONG TROOPS.*

THE following suggestions, although non-official in their nature, are, in a measure, selected from official instructions on the subject of cholera and other diseases of an epidemic nature, and with a view to the possible recurrence of cholera in garrisons and camps, are submitted in the hope that they may be useful to officers concerned. They are primarily addressed to the responsible Medical Officer, and his duty is to place himself in communication with the officer commanding and controller on the spot, in order that they may severally act upon his recommendations.

1. If cholera threatens, or has actually appeared, examine every locality in and about the barracks; suggest needful improvements and alterations in them.
2. Take steps to insure thorough cleanliness in, outside, and around places occupied by troops.
3. Attend to space per man, and ventilation in barracks and hospital; to water supply, drains, latrines, food, clothing, duties, and exposure of the men. Night duties should be as few as possible, and the sentries wear warm clothing.
4. Arrange so that all men attacked by diarrhoea, or in fact any form of illness, be immediately sent from their barrack-room to hospital, and see that means exist of giving them immediate professional help, and every needful attention.
5. Place the troops in quarantine in regard to the civil population. Prevent communication with infected localities and the entrance of strangers into camp or barracks. The families of soldiers married with leave should, if

* Issued by C. A. Gordon when Principal Medical Officer in the Southern District of England.

living in infected localities, be removed from them. For those married without leave, humanity demands that, as far as possible, sanitary measures should be extended to them, and no doubt some commanding officers may effect a great deal in this way, by judicious aid from the canteen funds of regiments.

6. Have fires lighted in barrack rooms irrespective of season ; do all that is possible to avert panic, and keep up the spirits of the men.
7. Use disinfectants in all places containing decomposing matters, remembering however, that perfect cleanliness is itself the best disinfectant. Disinfectants are obtained by requisition on the Control Department approved by the principal Medical Officer.
8. Warn the men against intemperance and excesses of whatever kind ; recommend that they be restricted as far as possible to their regimental canteens, that they have tea or coffee, or, if practicable, breakfast before mounting guard or going on morning duty.
9. If circumstances seem to demand the measure and are favourable for it, recommend that the men be encamped, remembering however, that the facilities for the measure are far less in the United Kingdom than they are in India.
10. Make arrangements so that men taken ill may be quickly, and with as little inconvenience as possible, taken direct to hospital, and that their barrack bedding may, if necessary, be also conveyed thither for their use.
11. Take steps so that the barrack room, whence one or more men with cholera have been sent to hospital, may be cleared out, whitewashed, and disinfected.
12. If cases occur in camp, change the ground if practicable, proceeding at right angles to the prevailing wind. If this cannot be done, strike the tents and clean the position, so far as this can be done, before pitching them again.

13. Women and children attacked by the disease to be treated in the "Female" hospital, provided one exists. If there is none, have one or more rooms in barracks cleared out for the purpose.
14. If the state of the weather and other circumstances are favourable, have tents pitched for all patients with cholera. If this cannot be done, remove all the ordinary cases from hospital, together with their bedding; let them be accommodated in tents, barrack rooms, or even in buildings obtained temporarily for the purpose; treat all cholera patients in hospital, equipping their beds with their barrack bedding.
15. Apply to your commanding officer for special orderlies to attend cholera patients; see that these attend none others, that they disinfect all excretions and discharges of the patients, as well as water closets used by them, and that they keep themselves perfectly clean.
16. Corpses should be removed and buried as quickly as possible, and autopsies only performed in very special cases.
17. Have a good supply of ice available in hospital for the use of the sick.
18. A vessel containing chlorides, or Condly's Fluid should be near the beds of patients, for the immediate disinfection of clothes removed from or used by them.
19. The orderlies should wash their hands immediately after touching the patients, or their clothes, and disinfect them at the same time with Condly's Fluid.
20. Disinfect in a similar manner all glasses and other vessels used by the patients.
21. Whenever possible, all discharges from patients should be received directly into vessels containing a disinfectant. They should, moreover, be specially disposed of, so as to destroy risk of extension of the disease by means of them.

22. Free communication between the military and civil Medical authorities in an infected locality is strongly urged. They should consult and devise measures together for investigating the existing, or averting the threatened evil, bearing in mind that the sanitary well-being of soldiers and civilians depends upon and is often affected by conditions bearing in the first instance upon only one of these classes. Questions of public health concern all members of the community alike.
 23. Remember that the earlier and more complete the precautions taken against cholera, the more successful will they be. Remember also, that when such precautions are delayed until the disease has actually appeared, the measures which might, in the first instance, have been successful, may, in the second, themselves prove a source of injury, and intensify the evil they are intended to guard against.
 24. The above suggestions are for the most part epitomised from military and other "Regulations." Of such are the "Instructions" issued by the War Office in 1871; the Queen's Regulations; the measures for the prevention of cholera in Northern India by the Sanitary Commission for Bengal, 1864; the instructions issued by the Medical officer of the Privy Council, 1873; those by Dr. Lankester against scarlet fever; and the Code des Officiers de Santé of the French army.
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